S. Hrg. 98-66

EXTENSION OF THE DEFENSE PRODUCTION ACT

HEARING

BEFORE THE

COMMITTEE ON BANKING, HOUSING, AND URBAN AFFAIRS UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

FIRST SESSION

ON

THE EXTENSION OF THE DEFENSE PRODUCTION ACT'S AUTHORITY FOR 5 YEARS TO PROVIDE LONG-TERM CONTINUITY TO DEFENSE PREPAREDNESS PROGRAMS, TO STRENGTHEN PREPAREDNESS PLANNING, AND TO MAINTAIN THE RESPONSIVENESS OF THE DEFENSE INDUSTRIAL BASE

MARCH 21, 1983

Printed for the use of the
Committee on Banking, Housing, and Urban Affairs

U.S. GOVERNMENT PRINTING OFFICE
19-468 O WASHINGTON : 1983

S241-14

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CONTENTS

MONDAY, MARCH 21, 1983

Page

Opening statement of Senator Trible 1

WITNESSES

J. Dexter Peach, Director, Resources, Community and Economic Development Division, General Accounting Office 3
  Prepared statement 3
    Extension of the DPA 3
    Chronology of recent GAO involvement in title III 4
    Economic and national security benefits and costs should be considered 4
    Analysis of FEMA's title III cobalt proposal 4
    Data 5
    Assumptions 5
    Methodology 6
    Title III should be amended 6
Lawrence Brady, Assistant Secretary for Trade Administration, Department of Commerce 9
  Prepared statement 9
Paul K. Krueger, Assistant Associate Director for Resources Preparedness, Federal Emergency Management Agency 11
  World class mines 11
  Prepared statement 12
    Extension of the Defense Production Act 12
  FEMA study entitled, "Alternative U.S. Policies for Reducing the Effects of a Cobalt Supply Disruption—Net Economic Benefits and Budgetary Costs" 15
    Foreword 16
    I. Executive summary 18
    II. Background 27
    III. Foundation for the development of alternative supply protection policies 45
    IV. Evaluation of alternative supply protection policies 51
    V. Conclusions and recommendation 73
    Appendix A: Domestic cobalt production plans and potential 75
    Appendix B: Econometric projections 82
    Appendix C: Methodological notes 97
    List of exhibits:
      Exhibit 1: Aircraft engine temperature and thrust-to-weight capability 29
      Exhibit 2: U.S. cobalt suppliers, 1979 (originating countries) 37
      Exhibit 3: Map of Southern Africa 39
      Exhibit 4: Concentrations of communist military and civilian advisers 40
      Exhibit 5: Cobalt mine production (percent) 42
      Exhibit 6: U.S. cobalt reserves and potential production 48
      Exhibit 7: Alternative policies U.S. cobalt consumption, 1981–90 57
      Exhibit 8: Alternative policies cobalt price, 1981–90 58
      Exhibit 9: Normal cobalt supply, direct economic net benefits and federal outlays, 1981–90 59
      Exhibit 10: U.S. cobalt consumption, 1984–87 62

Page
Paul K. Krueger, Assistant Associate Director for Resources Preparedness, Federal Emergency Management Agency—Continued
  FEMA study entitled, "Alternative U.S. Policies for Reducing the Effects of a Cobalt Supply Disruption—Net Economic Benefits and Budgetary Costs"—Continued
    List of exhibits—Continued
      Exhibit 11: Effectiveness of alternative supply protection policies, cobalt supply disruption 63
      Exhibit 12: Cobalt price 64
      Exhibit 13: Cobalt processing and trade flow, 1985 normal and disrupted supply 66
      Exhibit 14: Zaire cobalt supply disruption, direct economic net benefits and Federal outlays, 1981-90 68
  National defense stockpile inventory of strategic and critical materials 108
  Cost estimates for expiration of the Defense Production Act 116
  Letter to George Bush, President of the Senate 123
    A.—Proposed legislation to extend the DPA for an additional 5 years 124
    B.—Impacts of the expiration of the DPA 125
  Response to questions regarding the FEMA cobalt analysis and the GAO evaluation of that analysis 127
Richard Donnelly, Director, Industrial Resources, Office of Under Secretary for Research and Engineering, Department of Defense 101
  Prepared statement 101
Panel discussion:
  Priorities and allocation of resources 102
  Machine tool order program 104
  Guidelines to stockpiling 105
  Disagreement over length of reauthorization 115
  Funding programs 116
  Problems in major industries 118
  Purpose of $200 billion appropriation 119

EXTENSION OF THE DEFENSE PRODUCTION ACT

MONDAY, MARCH 21, 1983

U.S. SENATE,
COMMITTEE ON BANKING, HOUSING
AND URBAN AFFAIRS,
Washington, D.C.

The committee met at 10 a.m., in room 538 of the Dirksen Senate Office Building, Paul Trible presiding.

Present: Senators Trible, Garn, Gorton, and Hecht.

OPENING STATEMENT OF SENATOR TRIBLE

Senator TRIBLE. The Senate committee hearing on the Extension of the Defense Production Act will come to order, and I'd like to welcome you today to these hearings.

The Defense Production Act is the foundation of our Nation's defense preparedness capability in times of war and peace. The bill provides the President with authority to divert certain materials and facilities to defense purposes, to reduce the time required for full mobilization, to insure the availability of strategic and critical materials, including energy, and to insure productive capability and supply and to develop preparedness programs.

This legislation has been routinely extended since the 1950's, but in recent years it's come perilously close to expiring in the logjam of legislation that invariably arises in the closing days of our sessions.

For this reason, I'm strongly advocating a 5-year extension of the Defense Production Act. This act contains vital contracting authorities needed to avoid substantial delays and accompanying increases in cost of defense contracts. At a time when eliminating waste in Government spending is in everyone's mind, it seems foolish to continue flirting with the expiration of the statute that's responsible for saving taxpayer dollars.

The administration strongly supports the extension of 5 years of the Defense Production Act and has submitted legislation to the Congress to accomplish this purpose.

I would like that a letter from General Counsel of the Federal Emergency Management Agency to Vice President Bush explains the need for long-term extension of the act and the problems arising with its expiration be included in this record. Without objection, so ordered.

[Letter referred to can be found on p. 123]

Senator **Trible**. In addition to FEMA, the Department of Defense and the Department of Commerce has both expressed their support for a 5-year extension of the Defense Production Act and I'm sure they will reiterate that position here today.

Now it appears there will be an effort in the House of Representatives to limit the extension of the Defense Production Act to only 6 months. I fail to see the logic or the propriety of that course of action. The extension of the Defense Production Act for 5 years is important, as it will permit the continued improvement of our Nation's ability to mobilize resources in times of national emergency and I hope the committee will support legislation to accomplish that end.

Before we hear from the panel of distinguished administration witnesses that are arrayed before us, I'm going to call on the General Accounting Office to present testimony about title III.

A brief review of recent events is needed to put this issue in perspective. During last year's consideration of the continuing resolution funds were added without hearing or thorough debate providing $50 million to the Defense Department under section 303 of title III of the Defense Production Act. Section 303 extends the authority to the executive branch to establish price guarantee programs for industrial minerals and materials. These funds have not yet been expended, but they remain available to DOD. With the failure of last year's floor action on the extension of this legislation, the administration apparently agreed to request $200 million in this year's budget for title III programs in exchange for securing final passage of the bill. These funds are in the President's budget and, if approved, there will be a quarter of a billion dollars available to DOD under title III.

One of the proposed uses of these funds is to establish a price guarantee program on cobalt, a highly questionable expenditure in my judgment. The Congressional Budget Office has prepared a study of this proposal and concludes it doesn't make economic sense. Neither the DOD nor FEMA has provided adequate justification to the Congress on the expenditure of these funds. I think this deserves a very careful look before it's approved.

The committee has requested the General Accounting Office to conduct an analysis of the proposal and we look forward to that testimony here today. Once we've heard from GAO, we will hear from the panel of administration witnesses and each of you are invited to comment on GAO's finding in addition to your own testimony.

You're welcome here today and I look forward to this session. Senator Garn.

Senator **Garn**. Thank you, Senator Trible.

May I welcome all of you here and I just want to take this opportunity to thank Senator Trible for his interest in the Defense Production Act. It is a very important issue.

As a new member of the committee, he expressed a great deal of interest in the DPA and I was pleased that he was willing to accept my request that he take the lead on this particular issue and chair the hearings. I certainly would agree with the Senator that the 6-month extension talked about in the other body makes no logical sense at all. Forgetting about the substance of the Defense Production Act, just with the schedule that we face, why in the world they would want to come back every 6 months and struggle with this issue again makes no sense whatsoever to me.

So I hope we can get a reasonable extension, and if they are not willing to agree to 5 years, certainly a multiyear extension does make sense.

Senator Trible, I do want you to know how much I appreciate your willingness to take the lead on this issue and to chair these very important hearings.

Senator **Trible**. Thank you, Mr. Chairman.

My distinguished colleague from Nevada, Senator Hecht.

Senator **Hecht**. No statement, Mr. Chairman. I want to hear the witnesses. Thank you.

Senator **Trible**. All right. Now do we have Mr. Peach with us this morning?

Mr. **Peach**. Yes, sir.

Senator **Trible**. Gentlemen, if you all will give up your seats to the GAO at this point, but please don't go far. We will be calling on you in a moment.

STATEMENT OF J. DEXTER PEACH, DIRECTOR, RESOURCES, COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION, GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY CHARLES COTTON AND LEN ELLIS

Mr. **Peach**. Thank you, Mr. Chairman. I have with me Mr. Charles Cotton and Mr. Len Ellis who are chief evaluators working in the area looking at the proposals you have before you today.

[Complete statement follows:]

Statement of J. Dexter Peach, Director, Resources, Community, and Economic Development Division

Mr. Chairman and Members of the Committee: We appreciate this opportunity to comment on extending titles I and III of the Defense Production Act (DPA) beyond their current March 31, 1983, expiration date and using the act's title III authorities to provide financial and other assistance to private industry for the production of nonfuel minerals and materials needed for national defense. Title III, together with title I priorities and allocations, facilitates the production of goods and services necessary for national defense.

While we agree with extending title I and III authorities, we believe that the Congress should consider amending title III to assure that the economic benefits and costs, as well as the national security implications, of each title III proposal are properly addressed. Further, the Congress should consider amending the act to provide the Congress with ample opportunity to review each title III proposal. I will comment further on these issues after briefly summarizing why we believe that the act's authorities should be extended and GAO's involvement with title III over the past 2 years.

EXTENSION OF THE DPA

The act, originally intended to terminate in 1952, has been extended by a series of amendments ranging from 30 days to 2 years and has never lapsed for longer than a day or two. The current importance of this act is reflected in this committee's report which accompanied the 1981 extension. It states that:

"The Defense Production Act is the sole statutory vehicle for insuring that the nation's industrial base is kept in a state of readiness in peacetime so that new programs may be initiated and standby programs may be expanded in the event of mobilization."

In January 1983, the Department of Defense stated that the act "is a statutory cornerstone of our country's national security."

At the October 8, 1982, request of the former Chairman of the Subcommittee on Economic Stabilization, House Committee on Banking, Finance and Urban Affairs, GAO has just completed an evaluation of the effects of a lapse in the DPA, focusing on the priorities and allocations provisions of title I. GAO found that a lapse of DPA could result in (1) difficulty in acquiring desired products, (2) schedule or delivery delays, (3) cost growth, (4) problems in administering and enforcing DPA authorities and regulations, and (5) contractual problems.

It would appear that the loss of title I and III authorities could have a widespread impact on the way Defense satisfies its procurement and readiness responsibilities. Thus, we recommend that the Congress extend their expiration date.

CHRONOLOGY OF RECENT GAO INVOLVEMENT IN TITLE III

Our views on the need to couple amendments to title III with extension of the act's authorities are based on work we have done over the past 2 years, including that accomplished in response to your request that we testify here today.

First, following an October 7, 1981, letter from Senator Proxmire to the Director of the Office of Management and Budget stating that he intended to ask GAO to review any title III proposal, we have regularly monitored executive branch activity relating to title III.

Second, we issued a report [1] on the need to weigh the benefits and costs of domestic mining against other mitigating alternatives, including stockpiling and the development of substitutes, to determine the most effective approach to assuring our national security and economic well-being.

Third, we provided comments on a bill entitled the Defense Industrial Base Revitalization Act questioning the viability of certain contemplated title III proposals to either reduce long-term national vulnerability in strategic and critical mineral markets or improve the ability of domestic producers to compete at home or abroad.

Finally, in response to your testimony request, we evaluated, to the extent that time permitted, an August 1982 Federal Emergency Management Agency (FEMA) proposal for using title III to help meet the National Defense Stockpile cobalt goal. At your request, we limited our review primarily to the most cost-effective means of meeting this goal.

ECONOMIC AND NATIONAL SECURITY BENEFITS AND COSTS SHOULD BE CONSIDERED

Certainly, we support a well-designed, cost-effective Federal program to improve the readiness of this Nation's industrial base and to prepare for national defense mobilization. Title III authorizes a variety of alternatives to stockpiling, including loans, loan guarantees, purchases, commitments to purchase, and floor price guarantees (price supports) to expand our productive capacity and supply.

Title III was used with varying degrees of success during the Korean conflict and the aftermath arms buildup, but has been used infrequently since then. The Department of Defense has been authorized $50 million in fiscal year 1983 and has requested an additional $200 million in fiscal year 1984 for title III purchases and purchase commitments of metals, minerals, and materials.

Over the past 2 years, the executive branch has discussed the possible use of title III to expand domestic production of cobalt, titanium, aluminum ore (refactory bauxite) and natural rubber (guayule). We believe that a proper analysis of these proposals' economic and national security benefits and costs would show that, at least for some strategic and critical minerals, title III authorities may not be the most effective alternative for promoting long-term national defense.

The only recent executive branch analysis pertains to FEMA's cobalt proposal. We believe that the analysis raises important issues concerning which economic and national security benefits and costs should be considered. However, due to the time constraint in responding to this committee's request, it has not been possible for us to either draft a formal report or obtain FEMA's comments on our present assessment.

ANALYSIS OF FEMA'S TITLE III COBALT PROPOSAL

In his April 5, 1982, program plan and report to the Congress required by the National Materials and Minerals Policy, Research and Development Act of 1980 (P.L. 96-479), the President stated that an analysis was ongoing to determine whether circumstances exist under which the use of Defense Production Act incentives would be more cost effective than stockpile purchases. The first such analysis was performed by FEMA to identify the most economical investment alternative for providing a level of cobalt availability equivalent to a strategic stockpile of 85.4 million pounds.

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[1] "Actions Needed to Promote a Stable Supply of Strategic and Critical Minerals and Materials," GAO/EMD-82-69, June 3, 1982.

In an August 1982 report, FEMA recommended that using title III to stimulate domestic cobalt production would be a more cost-effective alternative to meeting the stockpile goal than purchasing the cobalt on the open market. FEMA proposed a 5-year Federal floor price guarantee to stimulate 10 million pounds of domestic production annually, supplemented by open market stockpile purchases of 14.2 million pounds over a 10-year period. This option was recommended over stockpile purchases on the open market of 44.6 million pounds over a 10-year period with no domestic production.

The basis for FEMA's recommendation was a cost comparision which concluded, in part, that cumulative Federal expenditures would be substantially less under its proposed option. However, the results of such an analysis are only as valid as the data, assumptions, and methodology used. We question the results of FEMA's analysis and resulting recommendation based on what we regard as deficiencies in each of these areas.

DATA

For example, the FEMA data base reflects a 11 percent discrepancy in the amount of cobalt in the stockpile. It does not take into account 5.4 million pounds of cobalt acquired under a July 10, 1981, contract. One result of this oversight is a significant increase in the cost of the stockpile-only option (between $136 million and $198 million).

ASSUMPTIONS

Further, there appears to be no reasoned basis for FEMA's projected cobalt price. Studies by both Commerce and Interior in 1981 projected a price of $18 a pound or less through 1990, the time frame of the FEMA analysis. Yet, FEMA's nondisruption stockpile-only option assumes a price increasing to over $36 a pound, or more than double the Commerce and I:nteror projections. This pricing assumption added an additional $274 million to the cost of the stockpile-only option.

FEMA's price assumption also appears unrelated to historical or existing market conditions. The price of cobalt fell from its record producer high of $25 a pound in February 1979 to $12.50 a pound in February 1982 and commodity analysts were projecting that its short-term price would continue to decline. Since the FEMA analysis was completed, the dealer price of cobalt has declined to below $6 a pound. FEMA's divergence in its pricing assumption from both historical and existing market conditions has a major impact on the results of its cost analysis.

FEMA's recommended option also assumes that Federal price guarantees and related expenditures will end after 5 years. However, this assumption would be valid only if FEMA's projected price for cobalt is accepted.

Under a federally guaranteed floor price program, participating producers would be paid the difference between the guaranteed price and the market price. As long as the market price of cobalt remains below domestic production costs, Federal subsidies will be required to maintain domestic capacity. Therefore, Federal price guarantees may have to be continued far beyond the 5 years envisioned by FEMA and may have to be increased as the grade or quality of ore decreases.

For example, FEMA's analysis includes a minimum floor price of $15 a pound. At today's market price of roughly $6 a pound, a Federal subsidy of $9 a pound would be required. If the floor price increases to $25 a pound also included in FEMA's analysis, the Federal subsidy would increase to $19 a pound. Thus, if the market price of cobalt remains at $6 a pound, the floor price guarantee would cost the Federal Government between $450 million and $950 million over the 5-year program. Yet, this subsidy would result in no increase in the amount of cobalt in the stockpile since, under FEMA's recommended option, the 14.2 million pounds to be acquired for the stockpile would be purchased at additional cost on the open market.

Conversely, a contract at today's market price to acquire all the cobalt still needed to meet the stockpile goal would cost $235 million. Filling the cobalt stockpile goal now would also eliminate any potential future stockpile deficit if domestic production ends once the Federal price guarantee program is terminated. Thus, FEMA's recommended title III option could incur not only greater Federal expenditures over the life of the price guarantee program but also future costs not applicable to the stockpile-only option.

METHODOLOGY

Finally, FEMA's methodology raises questions concerning important, but nonquantifiable, costs or risks that should be taken into account in reaching a sound conclusion on the national security issues associated with any title III proposal. The FEMA proposal apparently accords no weight to the national security consideration of the United States having only limited, marginally economic domestic cobalt reserves that could be extracted under any known mining technology. Based on a 1981 Bureau of Mines appraisal of domestic cobalt availability,[2] a Federal floor price guarantee of $15 a pound would assure domestic production of 10 million pounds per year for only 10 years. Another 9 years of domestic production may be possible at $25 a pound. The Bureau's appraisal concludes that "U.S. production would provide only short-term relief from the Nation's dependence on imports and will not significantly alter the structure of dependence over the long-run."

Given the physical limiations of domestic cobalt reserves, it would seem prudent to retain this in-the-ground stockpile for periods of actual national emergency instead of selling it on the open market during peacetime as FEMA recommends. FEMA's analysis does not acknowledge the potential costs and national security risks associated with the peacetime depletion of our limited cobalt reserves and the resulting potential increase in long-term U.S. vulnerability to supply disruptions.

In a September 1982 study [3] of the Federal policy options relating to cobalt, the Congressional Budget Office states that, if domestic cobalt is reserved for national emergencies, "the protection afforded by stockpile cobalt extends beyond the mandatory three years, since domestic ore bodies could be brought on-line within that time and greatly extend the years of protection afforded by the stockpile." Such potential "protection" would be significantly compromised, if not lost, under FEMA's recomended option.

Besides the physical security they afford, domestic reserves also provide a degree of economic protection from contingencies that might cause sharp price increases. Once the leverage afforded by domestic reserves has been eliminated, the Federal Government may have to pay a substantially higher price for foreign supplies.

TITLE III SHOULD BE AMENDED

Given the preceeding assessment, we believe that FEMA's analysis does not provide all the information necessary to (1) identify the most economical investment alternative to meet the stated stockpile goal and (2) understand national security considerations relating to depleting our limited domestic cobalt reserves. Further, the decline in the market price of cobalt since FEMA's analysis was published makes FEMA's recommended option even less attractive.

Title III does not now require that economic and national security benefits and costs be considered prior to Federal funding of loans, loan guarantees, purchases, commitments to purchase, or floor price guarantees. We believe that the Congress should consider amending the act to require that these benefits and costs are properly addressed and to give the Congress ample opportunity to review each proposal and associated benefits and costs before entering into any commitment to provide financial or other assistance under title III.

Let me conclude by recapping the most essential points in my testimony.

First, we agree with extending title I and III authorities of the Defense Production Act relating to nonfuel minerals and materials, but believe that amendments to title III are needed.

Second, while we foresee instances where the use of title III authorities may be needed to stimulate domestic production of stategic and critical minerals and materials, our work indicates that title III authorities may not always be the most effective alternative for promoting national security. Therefore, we believe that the Congress should consider amending title III to assure that the economic and national security benefits and costs of each title III proposal are properly considered.

Third, since the results of any such analysis are only as valid as the data, assumptions, and methodology used, we believe that the Congress should also consider amending the act to give the Congress ample opportunity to review each title III proposal prior to entering into any commitment to provide financial or other assistance.

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[2] Department of the Interior, "Cobalt Availability-Domestic," Bureau of Mines Information Circular 8843, 1981.

[3] Congressional Budget Office, "Cobalt: Policy Options for a Stategic Mineral," September 1982.

Mr. Chairman, that concludes my statement. I welcome any questions the committee may have.

Mr. **Peach**. And I might add, Mr. Chairman, that because one could also envision a national emergency occurring, appropriate language could be included in the legislation providing for a waiver of full study and review requirements in an emergency situation with appropriate provision for congressional notification. So I think those types of concerns can be taken into consideration.

That concludes our statement and we will be pleased to respond to any questions.

Senator **Trible**. Mr. Peach, we thank you very much for your testimony here today.

Let me direct a question to you if I might. You state in the testimony the act should be amended to provide Congress ample opportunity to review title III proposals and applicable economic and national security benefits and costs before entering into any financial obligation.

How do you suggest, more specifically, that that might be accomplished?

Mr. **Peach**. Well, first, I think there are several alternatives that you could use for dealing with that particular question. I won't say that we've conducted a full evaluation of which may be the most appropriate alternative in this circumstance, and that is something that our legal people could work with the subcommittee staff on.

Among the alternatives that could be considered would be a requirement that any proposal be included in the President's fiscal year budget submission, a requirement that any proposal be specifically authorized by law, or a requirement that the proposal not be funded or obligations entered into until it has been made available to the appropriate congressional oversight committees for a specified period of time.

There is a provision similar to that currently in title III with respect to loans and loan guarantees above a set amount but not to purchases and commitments to purchase. So there is some precedent for that kind of provision existing on a limited basis in the existing legislation.

Senator **Trible**. Well, I thank you for that preliminary answer and that's a matter I would hope that we would pursue and we look forward to working with you and your staff in bringing that about.

On page 7 of your testimony you note that a guaranteed program would cost between $450 million and $950 million, yet fail to add even a single pound of cobalt to the stockpile. This is compared with the approximate cost of $235 million to buy the necessary cobalt outright.

It does seem to be a rather substantial cost differential there and it would seem to suggest, at least by your analysis, that the purchase approach is the obvious choice. That again, I think is a matter that we will want to pursue here today.

Mr. **Peach**. If I might add, Mr. Chairman, we the benefit of knowing the $6 current price. At the time FEMA was making its analysis, it is questionable how much foresight the analysts could have as to an exact price. But in reviewing the information available to them at the time, as indicated by my testimony, we have some questions about the prices used to project costs under the various alternatives.

There was information indicating a lower market price was likely. So I think it does raise a number of questions and as we have seen, the price has dropped substantially making the purchase for the stockpile look much more opportune now.

Senator TRIBLE. Well, I would ask you to remain with us after my colleagues have asked their questions so we might have the benefit of your input as well in the later stages of our hearing today when we hear from the administration witnesses.

Mr. PEACH. We'll be pleased to.

Senator TRIBLE. Senator Hecht.

Senator HECHT. I would like to proceed and I relinquish my time this morning to hear the other witnesses.

Senator TRIBLE. Senator Gorton.

Senator GORTON. One question. If your suggested change in title III had been a part of the law for the last 2 years, how differently do you think the FEMA cobalt study would have been handled? Would the study itself have come up with a different result or would that simply have made it easier to criticize it outside of FEMA?

Mr. PEACH. I would suggest probably—well, let me back up and say it would be difficult for me to say whether the study would have come up with a different result because the study was made on a cost-comparison basis and we were suggesting cost/benefits as a kind of analytical approach that should be considered. There was not a requirement for that kind of study specifically to be done and to be laid before the Congress, particularly where purchases or purchase guarantees were being considered. I think the benefits of a study being available from FEMA is having it available for analysis, for close examination, for consideration of the assumptions on which the study is based, and for, as a matter of fact, another judgment as to whether that appears to be a reasonable course of action.

So I don't know that under those provisions the study results would have been any different, but I think that making available that information with an opportunity for close examination, given the dollar value of the commitments we're talking about in this area, is important.

Senator GORTON. Thank you, Mr. Chairman.

Senator TRIBLE. Thank you, sir.

We thank you very much.

Next we'll hear from the distinguished panel of administration witnesses: The Honorable Lawrence Brady, Assistant Secretary for Trade Administration, Department of Commerce; Mr. Paul K. Krueger, Assistant Associate Director for Resources Preparedness, Federal Emergency Management Agency; and Mr. Richard Donnelly, Director, Industrial Resources, Office of Under Secretary for Research and Engineering, Department of Defense.

Gentlemen, we welcome you here today. We also have Mr. Richards with us this morning.

STATEMENT OF LAWRENCE BRADY, ASSISTANT SECRETARY FOR TRADE ADMINISTRATION, DEPARTMENT OF COMMERCE, ACCOMPANIED BY JOHN RICHARDS

Mr. **Brady**. Mr. Chairman, I'm pleased to be able to present the Department of Commerce's and the administration's support for a 5-year extension of the Defense Production Act. As you indicated, sir, I do have with me this morning Mr. John Richards, who is the director of the office under me that handles this in the Commerce Department.

[Complete statement follows:]

TESTIMONY OF LAWRENCE J. BRADY, ASSISTANT SECRETARY FOR TRADE ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. Chairman and members of the Committee, I am pleased to have been called to appear before you today to present the Department of Commerce's and the Administration's support for a five-year extension of the Defense Production Act and my views on the inappropriateness of using the Act as a vehicle for job training grant, subsidy, and loan programs.

I would like to begin by emphasizing the importance to our national security of the authorities conferred upon the President by the Act. These authorities are vital to our defense.

Since 1950, the Act has formed the basis for much of the civilian support currently provided to existing national security programs and allowed us to maintain the necessary level of mobilization readiness. When first enacted, its authority was used to carry out virtually all of the economic mobilization measures taken during the military action in Korea. Today, the authority of the Act is used by various agencies to implement a number of important programs which support our national defense. Let me use my agency as an example.

Within the Department of Commerce, the authority of the Defense Production Act is implemented largely by the International Trade Administration's Office of Industrial Resource Administration (OIRA), under my jurisdiction. The President has assigned the Secretary of Commerce, by delegation through the Federal Emergency Management Agency, the principal responsibility for administering those aspects of the Act which affect the industrial resources of the United States. DPA activities comprise a large part of the overall mobilization responsibilities for which Commerce has authority. These responsibilities extend to support for current defense production and to industrial mobilization and readiness.

Title I of the Act authorizes the President to require industry's acceptance of and priority performance on certain defense contracts and orders, and to allocate materials and facilities in support of certain defense and energy programs. To accomplish this, my staff administers the Defense Materials System and the Defense Priorities System which help ensure that defense programs are maintained on schedule by providing priority treatment for the purchase of products and materials by defense agencies, contractors, subcontractors, and their suppliers. These systems also provide the administrative means by which the total industrial resources of the United States could be mobilized in an emergency.

Title III authorizes the President to support the expansion of the nation's productive capacity to meet our national defense needs. It concludes the authority to guarantee loans to private enterprise in order to expedite performance on Government contracts for materials and services needed for the national defense. It also contains authority to provide loans to private business for expansion of capacity, for development of technological processes, and for production of essential materials, including the exploration, development, and mining of strategic and critical metals and minerals. Title III authorizes execution of purchase agreements for strategic materials to support their domestic production, which reduces the need to stockpile.

Title VII of the Act provides authority under which representatives of industry and other interests may, with the approval of the President, enter into voluntary agreements serving defense purposes without violating the anti-trust laws.

Title VII also provides the basic authority for operation of the National Defense Executive Reserve—a pool of individuals with proven executive ability who have agreed to undergo special training to perform necessary Federal functions in a national emergency. The NDER is one of the most important elements in our efforts to develop programs which would make us capable of functioning efficiently in the event of such an emergency.

The Commerce Department's NDER program is administered by my OIRA staff, which is responsible for organizing and training the cadre of Industry executives who constitute the industrial chapter of the NDER.

Title VII also gives government the authority to collect proprietary data. Such information is essential to all aspects of industrial mobilization planning.

The mission of each of these important programs contributes to meeting the basic objective of the Defense Production Act, which is to assure the timely availability of industrial materials and products vital to a strong military readiness posture. The DPA is an essential part of national security planning.

In your invitation to me to testify before this Committee, you asked for my views concerning the consequences that would occur should the Congress fail to extend the DPA on a timely basis. Such failure, even for a short period, would be most detrimental to the continuity of these programs, thereby negatively affecting national security planning and the national defense.

For some time now, Congress, industry, and this Administration have expressed serious concern regarding the capability of the U.S. economy and its industrial base to meet an emergency surge in demand for defense production. The Defense Production Act authorities are vital to manage both the resources and industrial capacity of the U.S. to satisfy defense mobilization requirements.

However, management of our resources for mobilization readiness would be less effective if the basic authority to do so is clouded by uncertainty. Such uncertainty would result from an interim, short-term extension of the DPA as proposed in legislation currently under consideration in the House. For this reason, the Administration supports extension of the Act's authority for five years, an action which would not tie the Committee's hands should amendment of any of its provisions be desired during that period.

A short extension period could result in an inability on the part of industry and government to plan effectively the production schedules, inventories and capital investment needed to keep the industrial base healthy and competitive in the world marketplace. The importance of this cannot be overemphasized since the strength of our military defenses is inexorably tied to the economic health of our supporting industries.

Already U.S. industry suffers from the economic fallout of short-term rather than long-term planning. U.S. industries directly involved in defense contracting suffer from the uncertainty of single-year procurement policies which still prevails for most defense contracts. Adding further uncertainty to the industrial support programs with potential interruption in DPA authority can only make the situation worse.

You also asked me to comment on the appropriateness of using the DPA as a jobs-creation vehicle. While we support a five year extension of the Act's authorities as contained in Titles I, III, and VII, we cannot support using the Act as a vehicle for programs relating to skills training, grants to universities, industry subsidies, and loans and loan guarantees that are not specifically established to correct identified weaknesses in the defense industrial base. Such weaknesses can be adequately addressed to insure our ability to surge production when necessary, without recourse to this $6.75 billion program, which would aggrevate Federal deficits and drive up interests rates. We believe that these provisions, as envisioned, would not contribute to the national defense and that the Act's existing authorities are sufficient for this purpose.

We believe that the most cost-effective and logical approach to maintaining and revitalizing the defense industrial base is to select specific objectives and target them for the application of funds to solve identified problems. This approach must be planned, long-term and directed. It must evolve around a sound defense procurement system with stable projected requirements, multi-year contracts and funding, and sufficient long-range goals to allow U.S. industry to develop competitively the production capability to meet defense needs. Hand-in-hand with this is the need for uninterrupted authority to call upon and direct that capability to meet peacetime or mobilization requirements.

Mr. Chairman, I will be pleased to respond to questions from you and other members of the Subcommittee.

Senator **Trible**. Thank you, Mr. Brady.

Mr. Krueger.

STATEMENT OF PAUL K. KRUEGER, ASSISTANT ASSOCIATE DIRECTOR FOR RESOURCES PREPAREDNESS, FEDERAL EMERGENCY MANAGEMENT AGENCY

Mr. **Krueger**. I would say as an aside, that the phrase "promote peace among nations" is stated in the preamble to the bill giving the intent of the bill. The Federal Emergency Management Agency strongly recommends extension of the Defense Production Act for a 5-year period.

I'd also like to briefly address some of the testimony offered by Mr. Peach.

Senator **Trible**. I hoped that you would.

Mr. **Krueger**. I think economists, like philosophers, can argue how many angels can sit on the head of a pin.

I think it unfortunate that the GAO did not have more time to review the basic study that we prepared. It's an extensive study and it's highly technical and requires special expertise and knowledge in the assessment. I think that if the GAO had more time, and there was the opportunity to consult back and forth with our experts and their experts, the analysis would have been a little stronger.

WORLD-CLASS MINES

I would like to take exception to two or three items. First, the talk about the assessment of the Bureau of Mines that said such a program would only keep a mine operating for 10 years. I think before this very committee a year and a half ago there was testimony indicating that the two mines at that time being contemplated had sufficient reserves to be considered world-class mines—and those words in particular was used—"world class"—and it indicated that there was a 50-year-mine life for one of the mines and a 30-year-mine life for the second.

The penalty then for using those reserves is less severe because I would think that within that 50-year time period that there's an opportunity to develop sulfides which are on the Outer Continental Shelf. I think that program is well underway, and it represents a source of cobalt. There is also in U.S. territories the possibility of mining ocean mounts and finally the mining of deep sea nodules, so there are in fact alternative sources which will be coming onstream. The fact that there exist these 30–50 year land reserves that could be mined in the United States buys us some time to allow the development of those other resources.

Second, there was comment in Mr. Peach's testimony about why there was the limitation of only 5 years on the program of price supports. This is determined by the current depreciation laws which allow corporations to depreciate that capital investment over a 5-year period of time. Once the initial capital investment of any of these ventures had been fully recovered by the company, we would not extend these price supports.

Finally, the cost and benefits in the study are defined much more broadly than simple budget outlays. We are really talking about the costs and benefits to the U.S. economy, so we are talking about long-term reduction in our balance-of-payments deficit, increase of jobs, and so forth. When you accrue all of these benefits to the whole economy versus what are the costs to the total economy, I think the analysis is more favorable.

With regard to the statement that it will only cost $235 million to fill the current stockpile goal, I would say that that assumes the current price of $6 a pound is available to the Government when it enters the market to purchase 40 million pounds.

I welcome the opportunity to work with Mr. Peach and his associates and I think that together, his office and my office working back and forth, will tidy up some of these things. I would agree that at $6 a pound the proposal does not look as attractive as it did when the price of cobalt was $25 a pound, but that's the advantage of hindsight.

Thank you.

Senator TRIBLE. Well, hindsight is 20-20 and of course we're operating from that perspective today. We recognize that changing facts and circumstances influence the result of these kinds of studies.

I want to interject here with just one question. Are you familiar with the Congressional Budget Office study on cobalt?

Mr. KRUEGER. I have read it, yes.

Senator TRIBLE. Well, that study was conducted with ample time for inquiry and arrives at basically the same conclusions as Mr. Peach and his colleagues. So I think it is a matter to be pursued and we will have additional questions once we hear from all the members of the panel. We thank you.

Mr. KRUEGER. I would like to make a request that the FEMA study be considered as a part of the record and we would be happy to submit that to the committee. I think it represents a level of analysis which has not been done in the past and represents the type of analysis which most people would consider to be the state of the art.

Senator TRIBLE. It's so ordered.

[Statement of Mr. Krueger and copy of FEMA study follow:]

STATEMENT OF PAUL K. KRUEGER, ASSISTANT ASSOCIATE DIRECTOR FOR RESOURCES PREPAREDNESS, FEDERAL EMERGENCY MANAGEMENT AGENCY

Mr. Chairman and members of the committee, thank you for this opportunity to discuss with you the importance of the Defense Production Act of 1950 to our national preparedness.

On assignment by the President, the Federal Emergency Management Agency (FEMA) establishes policies for the Nation's mobilization preparedness program and coordinates department and agency functions to implement these policies. Authorities for these functions originate in the National Security Act of 1947, the Defense Production Act of 1950, as amended, and the Strategic and Critical Materials Stock Piling Act. Executive Order 10480, which implements the Defense Production Act, specifically charges FEMA with the responsibility for coordinating all mobilization activities of the executive branch of the Government, including activities related to production, procurement, manpower, stabilization, and transport. Our major effort is directed toward maintaining a strong and responsive defense industrial base to respond to national security emergencies. The Defense Production Act is a vital part of this effort.

More than 30 years ago, the Congress, with great wisdom and foresight, passed the Defense Production Act of 1950.

EXTENSION OF THE DEFENSE PRODUCTION ACT

The Defense Production Act of 1950 is one of the keystone authorities for emergency planning and preparedness and provides the statutory basis for mobilization readiness of the Nation's industrial and material resources. Continuation of these authorities is essential to the National Defense. Congress has recognized the importance of these vital authorities in reducing the time for mobilization of the Nation's resources in an emergency.

Title I is the unique authority for the defense priorities and allocation system which is fundamental to maintaining schedules for defense production with inherent cost advantages to the taxpayers. This operational system also provides the basis for orderly rapid expansion of defense production in a national security emergency. Title III provides authority for expansion of industry to expedite production and deliveries under defense contracts. Title VII authorizes the President to establish a nucleus executive reserve for employment during periods of emergency and to consult with representatives of industry, business, financing, agriculture, labor, and other interests for the making of voluntary agreements to help provide for the defense of the United States. Title VII also contains definitions and administrative provisions that establish the parameters of authorized programs and assure compliance. These authorities directly support the declaration of policy in a manner that leaves no doubt about the intent of the Congress to provide for our national security. The introduction of measures, like H.R. 13, that are well intended but are only vaguely related to these basic purposes is not appropriate and would interfere with carrying out existing authorities.

The administration opposes the provisions of H.R. 13 for several reasons. The training grants and equipment grants duplicate existing programs and are, therefore, not needed. Second, as a skill training bill, the grants and assistance should be provided through the appropriate program and agency rather than through the Defense Production Act. The bill would provide for training and equipment but would not create any long-term jobs. On the other hand, market forces are already at work to alleviate skill shortages in most areas. In 1980, colleges produced 60,000 engineers versus 40,000 engineers that graduated in 1975. At another level, employers who have been faced with shortages of machinists are making efforts to train machinists more quickly. The system, therefore, is working and Federal intervention is not necessary.

A simple 5-year extension of the Defense Production Act will clearly demonstrate the national commitment to mobilization of the Nation's resources in an emergency. In addition, a 5-year extension of the Defense Production Act provides long-term continuity to defense preparedness programs, strengthens long-term preparedness planning, and demonstrates a firm national commitment to maintain the responsiveness of the defense industrial base. The authorities in the act are used on a daily basis for maintaining our defense posture. Contractors develop production schedules based on assurance of obtaining materials, components, and other necessities through extensions of priorities on their prime defense contracts. This results in benefit to taxpayers from the reduced costs of defense programs associated with shortened production lead times and maintenance of production schedules.

If the act expires, ramifications could be dramatic:

The deployment of military forces in a major emergency is dependent on transportation assets made available for defense use under title I authorities. These assets include the civil reserve aircraft fleet (CRAF), contingency response program (CORE), and other rapid response deployment plans.

Title I of the Defense Production Act is the only Presidential authority (section 101(b)) available to prioritize defense and essential civilian transport movements in the civil economy in the event of a severe transportation disruption. This authority was used several times in the last 10 years and its use was planned in the recent air traffic controller and railroad strikes to insure the movement of defense goods and personnel. Its absence would reduce the President's ability to alleviate the impact of a major disruption to national transportation on the Nation's security.

The basic authority for the establishment and maintenance of the machine tool trigger order program is title III of the Defense Production Act. Without this authority the program would have to be terminated and existing standby purchase agreements cancelled. To date, 49 companies have been invited to participate and approximately one-third of these standby agreements have been signed (28 agreements) covering 2,136 items with contract values of over $432 million. The program is a Government/industry cooperative effort to cut mobilization lead-times by speeding delivery of machine tools essential to defense production.

New contracts for DOD guayule loan guarantee projects would be prevented and could delay the overall program. DOD purchase agreements under title III could not be continued.

The 11 NDER units sponsored by the major Federal departments would have to be disbanded and the reserve membership terminated by the departments and agencies with the resulting dispersal of talent and experience necessary for adequate mobilization preparedness.

In addition to current benefits, the Defense Production Act also provides an "insurance" element that makes possible response of the defense industrial base to emergency requirements of mobilization or war in minimum time. During World War II, 18 months of costly delays elapsed before a priorities system became effective. During the Korean war, 12 months passed before a priorities system became effective. Today, we have Government personnel at policy and operating levels. Contracting officers and production officers exercise the authorities on current defense programs. Contractors, subcontractors, and suppliers understand the authorities and responsibilities associated with defense (priority) orders. The complete system is in operation for current benefits as well as for the eventuality of a national security emergency.

In summary, the effectiveness of the Defense Production Act authorities has been proven every day for the past 32 years due to a significant degree to the assurance that the authorities would be continued for an indefinite period in the future.

If the Congress allows the act to expire, these benefits could be lost. Production schedules could be stretched out with inherent cost penalties. In the event of a national security emergency, defense production could be jeopardized while the Government attempts to reinstate a prioritis and allocations system. New legislation would be needed to authorize Government programs for expansion of industry to meet defense requirements. The loss of the national defense executive reserve would require recruitment of high level management and technical expertise at a time when industry would be engaged in major efforts to recruit similar skills. The Government would be unable to use the combined efforts of industry to develop new solutions to production constraints where there is the threat of antitrust actions. Finally, the machine tool program would be curtailed.

Extension of the Defense Production Act for 5 years will reinstate congressional declaration that the United States will maintain whatever military and economic strength is found necessary to promote peace among nations.

The Federal Emergency Management Agency strongly recommends extension of the Defense Production Act of 1950 for a 5-year period.

ALTERNATIVE U.S. POLICIES FOR REDUCING THE EFFECTS OF A COBALT SUPPLY DISRUPTION - - NET ECONOMIC BENEFITS AND BUDGETARY COSTS

AUGUST 1982

Federal Emergency Management Agency
OFFICE OF RESOURCES PREPAREDNESS

FOREWORD

The purpose of this study is to evaluate the economic and budgetary consequences of alternative policies for reducing the effects on industrial production and defense capability of a disruption in the supply of cobalt. Cobalt is a metallic element which has been repeatedly identified as vital to the aviation, aerospace, petroleum refining, electronics, and metal fabrication industries. In some uses, such as the production of high performance aircraft engines, it has no substitutes. Currently, the U.S. imports 93 percent of its annual cobalt consumption. About three quarters of this amount is supplied by the central African nations of Zaire and Zambia. Political instabilities in this region cause this source of cobalt supply to be seriously vulnerable to a disruption which would quickly and seriously impair U.S. production and defense capability.

The Strategic and Critical Materials Stockpiling Act sets forth provisions to decrease and preclude, when possible, a dangerous and costly dependence by the United States on foreign sources of raw material supplies in times of emergency. Under this legislation, retention of critical raw material stocks to provide for a three-year emergency is required. Executive Order 12155 assigns primary responsibility for planning the stockpile program to the Director of the Federal Emergency Management Agency (FEMA).

An alternative to the stockpiling of strategic and critical materials is the development of domestic sources of supply. The Defense Production Act contains specific provisions to reduce dangerous raw material dependence by promoting the development of domestic raw material production capacity.

This report describes the characteristics and uses of cobalt supplies, and compares the economic and budgetary impacts of developing a domestic production capability relative to stockpiling only. These comparisons are made under the assumption of a continuation of normal supplies, and under the assumption of a major supply disruption.

The research and analysis was performed within the Office of Resources Preparedness by Marilyn Biviano with the guidance of Paul Krueger. Econometric forecasts of cobalt consumption and prices were made by the Office of Commodity Policy, U.S. Department of Commerce using a cobalt market model developed by Russell Jones and Fred Siesseger of that Office. Robert Bruce of The Granville Corporation edited the study, and provided a final draft for review and publication by FEMA.

EXECUTIVE SUMMARY

INTRODUCTION

Cobalt is a strategic and critical metal without substitutes in many military and industrial applications. The primary use of cobalt is in the manufacture of aircraft engines and parts, which accounts for 45 percent of 1980 U.S. demand for this material. Cobalt is also vital to the aerospace, petroleum refining, electronics, and metal fabrication industries.

There is no domestic primary cobalt production. Secondary recovery fulfills approximately seven percent of normal requirements, requiring 93 percent to be imported. Three-quarters of these imports originate in the central African nations of Zaire and Zambia. Because of regional political instabilities and a growing Soviet influence, these supplies are considered to be highly vulnerable to disruption. Such a disruption would have serious consequences for U.S. military and industrial production capability.

This study addresses policy options for alleviating this vulnerability and compares their economic and budgetary costs. The options considered range from a policy of stockpiling alone, i.e., no domestic production, to that of stimulating a 10 million pound annual domestic production capacity supplemented by more limited stockpile purchases. The level of national security, i.e., assured material availability, provided by each alternative is equivalent to a current strategic stockpile inventory goal of 85.4 million pounds of cobalt.

Uses of Cobalt

Cobalt is a silvery grey metal that is harder and stronger than steel and maintains its high strength property in high temperature, corrosive, and stressful conditions. Cobalt also has superior ferromagnetism properties under high temperatures and valuable catalytic chemical properties.

The U.S. is the world's largest user of cobalt, consuming about one-third of world production. Approximately 70 percent of this consumption is in the form of high purity metal. Aircraft engine and parts production accounted for 45 percent of 1980 U.S. demand. The remaining major uses of cobalt in 1980 were electrical applications (15 percent), metal cutting and mining tool bit production (15 percent), chemical catalysts (10 percent), and chemical driers (10 percent). In each of these areas there are instances where cobalt is an essential (i.e., nonsubstitutable) input to products and processes which are critical to the maintenance or achievement of desired military and technological capability levels.

Cobalt's ability to maintain its high strength properties under adverse conditions make it a critical material in the manufacture of high performance aircraft engines. Improvements in supersonic maneuverability and persistence, vertical takeoff and landing capability, and smaller and less expensive aircraft are directly related to increases in the thrust-to-weight ratio of an aircraft's engine. The most significant contribution to increasing this ratio is increasing the engine's operating temperature. As heat increases, engine components are subject to increased rates of degradation which can be avoided only by the use of high temperature metal alloys. Because of cobalt's high strength and resistant properties, particularly at high temperatures, it has become an essential alloying element. More dramatically, Mr. Harry J. Gray, Chairman of the United Technologies Corporation, has stated in testimony before the House Armed Services Committee that military aircraft engines could not be built without cobalt.

Cobalt-rich jet engine replacement parts represent 60-80 percent of consumption in this sector. Replacement of these parts is required every six months to two years, depending on the specific part and type of engine. Trends toward higher thrust-to-weight ratio engines and their use on short haul aircraft will lead to a significant increase in the use of "cobalt rich" jet engine replacement parts.

The importance of cobalt to the defense and civil air fleet is illustrated by the effects of the tight cobalt supply situation experienced in 1978-1979. From 1978 to 1979, the delivery lead time for cobalt containing engine parts doubled, to two and one-half years. This tight cobalt supply situation in 1978-1979 illustrates cobalt's importance and far-reaching impact on defense production. According to a major jet engine producer, if high priority cobalt became unavailable today, over 20 percent of the current military and civil air fleet would become inoperable each year. As the new generation of higher thrust-to-weight, cobalt rich engines on short haul aircraft arrives, the air fleet survival time would be shorter.

Peacetime military demand for cobalt is expected to grow at an average annual rate of 19 percent from 1981 to 1985 and account for approximately 25 percent of the total U.S. consumption. Aircraft and parts production account for about two-thirds of peacetime defense requirements for cobalt. In wartime, it is estimated that direct defense requirements for cobalt would double.

Cobalt Supply

About 75 percent of U.S. cobalt consumption comes from Sub-Saharan Africa. In 1979, Zaire provided 55 percent of the U.S. supply. Zambia, adjacent to Zaire, supplied 18 percent. Other southern African countries supplied 3 percent. This geograhic concentration of cobalt supply is relatively insecure. Political and economic problems within and between neighboring countries coupled with the interdependence of African countries for transportation and energy seriously endanger cobalt supply security.

The capability of ground transportation in Sub-Saharan Africa to deliver cobalt exports to port is an important factor in its supply. The copper-cobalt mining districts of Zaire are inland and require a several thousand mile trip through Zambia, Zimbabwe and Botswana. These routes are limited and easily interdicted. For instance, the main railroad linking the mineral rich region of the Shaba Province of Zaire with the Port of Lobito in Angola was severed at several places as a result of civil strife in Angola which occurred in 1976. This rail link has not yet been restored. Zaire also has experienced insurgent attacks from Angola during 1977 and 1978 which disrupted copper and cobalt production. The threat of recurring attacks remains.

Cobalt is produced by a by-product of copper production. Although, at current high cobalt prices, air shipment is economically feasible, this is not the case for copper. Thus, if copper could not be exported, production would cease. If copper production ceased, so would the production of cobalt.

Growing concentrations of Warsaw Pact military and civilian advisors in Zambia and countries surrounding Zaire and Zambia also provide potential for supply disruption. Particularly important is the high concentration in Angola, bordering both Zambia and Zaire, estimated at 20,000 personnel. Ports on both the east and west coasts of Sub-Saharan Africa are open to Soviet naval forces.

Current Stockpiling Policies and Production Incentives

The National Defense Stockpile goal for cobalt is 85.4 million pounds. This is the difference between estimated wartime requirements and current assured supply. A stockpile acquisition program is currently under way at the direction of the President. When the current procurement of 5.2 million pounds is delivered, the stockpile will contain about 45 million pounds of cobalt. A shortfall of approximately 40 million pounds will remain.

The Bureau of Mines estimates recoverable U.S. reserves in place to be 255 million pounds, and 72.2 percent are recoverable at $25.00 per pound or less. The U.S. Geological Survey estimates domestic cobalt resources to be much larger and that excellent potential exists for finding additional, large economic reserves. The continued high price of cobalt has caused some mining companies to prepare extensive mining and refining feasibility and cost studies. However, these plans remain tentative because of their high cost of implementation and the threat that Zaire, with its state-controlled monopoly, would engage in predatory pricing by lowering the world price below the domestic break even point.

The Defense Production Act of 1950 was enacted to insure domestic productive capacity in the event of an attack on the U.S. by encouraging the exploration, development, and mining of strategic and critical materials. It provides a means of protecting critical domestic industries from adverse international market forces. Provisions set forth in Title III of the Act to carry out these objectives include purchases, commitments to purchase, guaranteed purchase prices, guaranteed loans for exploration, and development of substitutes for strategic and critical materials.

EVALUATION OF POLICY OPTIONS

The economic and budgetary effects of the options selected are evaluated under two sets of assumptions about the world cobalt situation. The first is a continuation of normal markets. The second is a supply disruption occuring in 1985 lasting one year and affecting 50 percent of the normal supply. The econometric forecasts of consumption and market price for each policy option include planned foreign cobalt capacity expansions and dominant producer output behavior. The timeframe of the analysis is 1981 through 1990.

The following options were selected for evaluation:

- Stockpile purchases of 44.6 million pounds over the ten year period with no domestic primary production (Stockpile Only).
- Stimulation of 5 million pounds annually of domestic primary production beginning in 1984,

supplemented with stockpile purchases of 29.2 million pounds over the ten year period (Hybrid 1).

- Stimulation of 7 million pounds annually of domestic primary production, supplemented with stockpile purchases of 23.6 million pounds over the ten year period (Hybrid 2).
- Stimulation of ten million pounds annually of domestic primary production supplemented with stockpile purchases of 14.2 million pounds over the ten year period (Hybrid 3). Ten million pounds is the maximum economic domestic production as estimated by the Bureau of Mines.

Each option provides for a level of material availability equivalent to a strategic stockpile of 85.4 million pounds.

Each option was evaluated against a base case of no change in cobalt supply using two criteria: 1) the net economic benefits produced over the 10-year planning period; and 2) the Federal expenditure requirement. These values were computed for a normal market situation and a 1985 supply disruption. Net economic benefits are the differences between gross benefits and gross costs. Gross benefits consist of the value of cobalt consumed at the market price plus the "consumer surplus", the additional economic value placed on the quantity consumed not reflected in the market price. Gross costs consist of import costs plus the cost of production of any domestically produced supply.

RESULTS OF THE ANALYSIS

Normal Market Situation

The options produce the following net economic benefits in comparison with "no policy". Each estimate is in 1981 dollars, discounted to its present value at the rate of 10 percent.

Option	Discounted Net Economic Benefits (million $)
Stockpile only	$-1,200
Hybrid 1	-290
Hybrid 2	+1
Hybrid 3	+384

The cumulative (not discounted) Federal expenditure requirements in 1981 dollars are:

Option	Cumulative Expenditures (million $)
Stockpile only	$1,122
Hybrid 1	633
Hybrid 2	496
Hybrid 3	360

Disrupted Supply Situation

The options produce the following net economic benefits. These values indicate the reduction in economic loss which would occur if no policy was adopted. This loss is estimated to be $3.9 billion.

Option	Net Economic Benefits (million $)
Stockpile only	$ 389
Hybrid 1	2,321
Hybrid 2	2,815
Hybrid 3	3,427

The cumulative Federal expenditure requirements are:

Option	Cumulative Expenditures (million $)
Stockpile only	$-774
Hybrid 1	-280
Hybrid 2	-175
Hybrid 3	+6

These values reflect the sale of stockpiled cobalt during the disruption at vastly increased market prices.

Vis-a-vis stockpiling, optimal domestic cobalt production in the proposed floor price range would amount to 13 million pounds annually. Economic constraints, as estimated by the Bureau of Mines, hold feasible domestic production to 10 million pounds per year.

Limitations of the Analysis

There are two principal limitations of this analysis. The first limitation is its use of cobalt market prices as a measure of the economic value of cobalt. If a cobalt shortage occurred, the normal level of industrial cobalt consumption could not be met. Cobalt is a critical component in most of its applications, and although it is a very small part of the final product value, its unavailability could result in significant industrial output losses. The economic cost of these losses is not estimated in this analysis. To the extent the industrial production losses result in reduced U.S. ability to maintain a wartime preparedness position or sustain wartime needs, national security costs are also incurred. The value of critical raw materials, such as cobalt, becomes inestimable in wartime; it must be acquired at any price. Neither the value to the economy or national security impairment incurred from lost industrial production associated with a cobalt shortage is estimated in this analysis. The second limitation is the omitted impact of material processing flows and required time paths for adjustment. The U.S. is in the tail position of cobalt material processing and trade flows. Cobalt mined outside of central Africa is typically exported for metal refinement. The U.S. refines very little, 1-2 percent, of cobalt production. Japan and Europe, also major cobalt consumers, refine most of the non-central Africa produced cobalt. If a serious disruption occurred, the U.S. could expect the major consuming countries to meet their needs before the needs of other countries. Based on current material processing/trade flows, an interruption of Zairean shipments could result in reducing the U.S. cobalt supply by 50 percent. The market model estimates the disruption impact on consumption to be only 21 percent, omitting the material processing flow consideration. Thus, in terms of both the impact of a central African cobalt supply disruption and the associated economic and national security costs of cobalt unavailability, this study provides only a lower boundary of their actual value.

CONCLUSIONS AND RECOMMENDATIONS

1. A cobalt stockpile policy that provides for a mixture of direct inventory purchases and government-stimulated domestic production is better than stockpiling alone.

2. The policy option known as "Hybrid 3", which provides for annual cobalt purchases of 1.42 million pounds and government-stimulated production of 10 million pounds annually, is superior to the other options considered. This is true whether the country faces normal market conditions or is subject to a supply disruption in the next ten years.

3. It is recommended that the "Hybrid 3" policy option be selected for implementation and that the necessary Federal programs to implement this option be undertaken as soon as possible.

II. BACKGROUND

CHARACTERISTICS AND USES OF COBALT

Cobalt is a silvery gray metallic element that is harder and stronger than steel and is found associated with copper, nickel, silver, lead, and iron ores. Because it maintains its high strength property in high temperature, corrosive and stressful conditions, it has become an essential alloying element. Cobalt also has superior ferromagnetism properties under high temperatures and valuable catalytic chemical properties. It is manufactured in both a metallic and a chemical form. Metallic grades of cobalt exceed 99 percent purity, chemical grades include organic and inorganic compounds and range from 20 percent to 80 percent in cobalt content.

General Uses

In 1980, the production of superalloys accounted for 45 percent of the U.S. consumption of cobalt. These superalloys are used primarily in the construction of aircraft engines and parts. Other major uses in 1980 were electrical applications (15 percent), metal cutting and mining tool bit production (15 percent), chemical catalyst (10 percent), and chemical driers (10 percent). The following paragraphs describe each of these major applications and their trends with respect to cobalt requirements.

Cobalt, as a jet engine alloy, became increasingly important in the 1960's, with the development of the high by-pass turbofan engine. Higher thrust-to-weight ratios were achieved through the development of this engine. Increases in the thrust-to-weight ratio of an aircraft's engine cause improvements in its supersonic maneuverability and persistence, vertical takeoff and landing capability, and permits the production of smaller and less expensive aircraft. The most significant contribution to increasing this ratio is increasing the engine's operating temperature (see Exhibit 1). As heat increases, engine components are subject to increased rates of degradation which can be avoided only by the use of high temperature metal alloys. Because of cobalt's high strength and resistance properties, particularly at high temperatures, it has become an essential alloying element.

Typically, a high by-pass turbofan jet engine (20 ton, 40,000 pounds thrust class) requires 110 to 132 pounds of cobalt in the finished aircraft. This cobalt is typically contained as follows[1]:

Component	Cobalt Content Pounds
Turbine blades and guide vanes	33-55
High pressure turbine disc	33
Combustor cans	33
Other components	11
Total	110-132 Pounds

The major replacement parts are the turbine blades and high pressure turbine disc. Frequency of replacement ranges from 6 months to 3 years. Typically, long haul aircraft require turbine disc replacement every 2-3 years, while short haul aircraft require disc replacement every 6-9 months.

The cobalt used in the new generation of high thrust-to-weight jet engines is of extremely high purity. For example, the cobalt used to produce high temperature rotating parts must be at least 99.65 percent pure.

Currently, most "cobalt rich" high by-pass turbofans are flying in long haul airliners. However, a new generation of nar-

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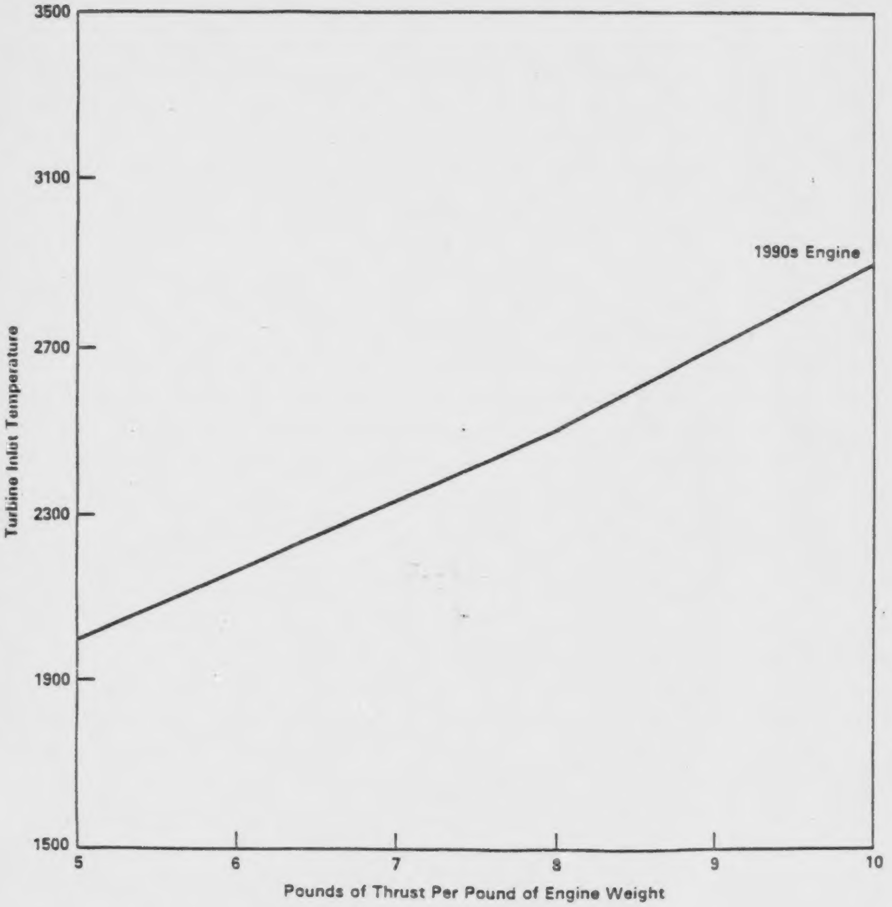
[1] Brook Hunt & Associates, Ltd., "Cobalt - A Review and Outlook to 1985," June 1981.

Exhibit 1

Aircraft Engine Temperature and Thrust-to-Weight Capability



Source: F. W. McAbee, Jr. "Turbine Technologies of Tomorrow," AIR FORCE MAGAZINE, January 1982.

row bodied, short haul airliners, with higher thrust-to-weight ratio turbofan engines, are planned to replace the short haul fleet of today during the mid to late 1980's. Thus, the emerging use of higher thrust-to-weight ratio, turbofan engines on short haul aircraft is likely to lead to a significant increase in the demand for "cobalt rich" replacement parts.

If high purity cobalt became entirely unavailable today, over 20 percent of the current U.S. military and commercial air fleet would become inoperable each year. As the new generation of higher thrust-to-weight, cobalt rich engines on short haul aircraft arrives, the airfleet survival time would be shorter.

Approximately one-half of the cobalt consumed in metal cutting and wear resistant applications is in cemented carbides. Used to produce metal forming and cutting tools, cobalt in cemented carbides acts as a cement or binder between carbide particles. The result is an exceptionally hard and tough product with the abrasion resistance necessary for machining steels, particularly high speed steels. While a family of carbides exist, virtually all cemented carbides use cobalt as a binder. Attempts to find other binders have been unsuccessful.

Since substitutes for cobalt in many critical applications have not been identified, industry conservation is substantial. The recycling of tool inserts (a technology developed by the Bureau of Mines) and improved tool performance has resulted in lower material requirements for a given level of tooling service. During the 1970's, the increase in consumption in carbides is reflective of higher production levels rather than reduced conservation.

Hardfacing alloys, high speed tool steels, cold-work and hot-work steels, and full alloy steels comprise the other half of cobalt's metal cutting and wear resistant applications. Hardfacing alloys provide an extra hard, abrasion resistant coating and tend to be produced by the same companies that produce cemented carbides. The cobalt used in hardfacing alloys is obtained from scrap generated in cemented carbide manufacturing. While cobalt may be substituted with another hardfacing binder, the by-product nature of the cemented carbide scrap and the existance of processes to recycle it into hardfacing alloys result in this downgraded use of cobalt to persist.

Cobalt is added to high speed tools in order to increase their metal cutting speeds at high temperatures. In cold work steels, cobalt increases abrasion and wear resistance in dies and punches. These steel tools contain 1-4 percent cobalt and represent minor applications. Other minor steel alloy applications are in aerospace, marine equipment and tooling, where a high strength to weight ratio is of paramount importance. In some tool steel and alloy applications, substitutes exist and are now replacing cobalt.

Cobalt is used in permanent or "hard" magnetic alloys and "soft" magnetic alloys to produce electrical and communication equipment. Permament magnets retain magnetic properties after removal from an external magnetic field while soft magnets do not. Applications of hard magnetic alloys include telecommunications, motors, repulsion devices, couplings, compact circuits, meters and, until recently, loudspeakers. Essential military applications include aircraft motors, relays and transformer cores for aircraft instrumentation, positioning of solenoid controls for military armaments and in missile control parts. Soft magnetic alloys are primarily used in induction cores and commercial and military generator laminations in aircraft gyro units.

Cobalt, as one of the three ferromagnetic elements, is a traditional constituent in permanent magnets. It provides magnetic remanence, resistance to demagnetization, at high temperatures, a crystal anisotropy, directional magnetization, and improves magnetic density or "energy" in permanent magnets.

Numerous magnetic alloys have been developed. The Alnico class of magnetic alloys developed in the 1950', became the major type of cobalt alloy used in producing magnets. Today there are over twenty different forms of Alnicos, with cobalt content varying from 5 to 35 percent. Alnico 5 (24 percent cobalt) and Alnico 8 (35 percent cobalt) are most prevalently used.

Rare-earth, copper-nickel, chromium-iron are also alloyed with cobalt for magnetic operations. Rare-earth cobalt alloys, containing up to 63 percent cobalt, are most widely used. Developed by the U.S. Government during the Vietnam war as a substitute for platinum-cobalt magnets used in traveling wave tubes for airborne radar, rare-earth magnets exhibit extremely high magnetic density and permanence. The major type of rare-earth magnet is the samarium cobalt alloy, though other rare-earth materials used include cerium, praseodymium and lanthanum. Samarium cobalt magnets contain 2.5 times more cobalt than Alnico magnets, and cost ten times that of Alnico. However, because of their high magnetic efficiency, they deliver four times the maximum energy product. The use of cobalt containing (samarium) rare-earth magnetic alloys is thus limited to applications with requirements of compactness with high energy.

Higher cobalt prices coupled with a high risk of unavailability have caused a substantial impact on cobalt usage in certain electrical applications. At one time, magnetic alloys were the single largest end use of cobalt. In 1980, they fell to 15 percent. Substitution was primarily achieved with ferrite ceramic magnets and low cobalt containing chromium-iron alloys. The ferrite ceramics are the least expensive alternative, and possess a high coercive force, light weight and high electrical resistivity. However, they have a lower resistance to demagnetization (higher magnetic leakage) and have a higher tooling cost. Alnico magnets in loudspeakers, until 1979, were the largest single use of cobalt containing magnets. In loudspeakers, there was little necessity or incentive to change. In 1978-1979 efforts to redesign cobalt out of magnets wherever possible were made. Largely substituted with ferrite magnets, today the loudspeaker share of the cobalt market has all but disappeared and, according to industry sources, will never return. Substitution of chromium-iron, low or cobalt-free magnetic alloys has been successful in several communication applications including telephone apparatus and in automobile instrumentation. Some consumption end uses show little substitution, e.g., motors, instruments and certain high temperature magnetic applications where the unique cobalt characteristics are highly desirable. The substitution that has already taken place has occurred rapidly because of the prior existence of quality substitutes.

Chemical Uses

Chemical uses of cobalt constituted 20 percent of 1980 consumption. As a catalyst for the desulfurization of crude oil, the largest single chemical application, cobalt has become essential in most refineries. Typically, a mixture of cobalt and molybydenum oxides are used to remove organic sulphur, nitrogen and oxygen. A nickel-molybydenum catalyst may be used when sulfur content is relatively low in some plants. However, it is less efficient, requires higher temperatures and pressure and the design of plants may prohibit substitution. As more high sulfur crudes are recovered, desulfurization requirements for cobalt will increase. Cobalt, as a catalyst, is also used in the production of polyvinylcholoride and polyester fiber. Demand remains strong in this area because substitution is difficult.

Cobalt compounds are used to increase the adherence of enamels to sheet steel. These enamel coatings which are termed ground coal frits, account for about .01 to .02 million pounds of U.S. consumption. A related use, pigments in ceramics and a decolorizer in glazes has fallen substantially, approximately 60 percent. Nickel oxides have served as substitutes, and in most cases with relative ease.

Additional uses include dryers in paints, ceramics, dyes dryers and pigments. While very traditional uses, dating back to the 1900's, consumption has fallen in recent years in all these applications. Cobalt is used as a catalyst to speed up the oxidation in oil base paints. Prior to the oil crises of 1973, oil base paints held most of the world's industrial paint market. Synthetic paints have largely replaced oil base paints in the market. Synthetic paints do not require a dryer and thus cobalt consumption has fallen in this end use.

Military Uses

Peacetime military demand for cobalt is expected to grow at an average annual rate of 19 percent from 1981 to 1985 and account for approximately 25 percent of total U.S. consumption. Aircraft and parts account for about two-thirds of peacetime defense requirements for cobalt. In wartime, it is estimated that direct defense requirements for cobalt would double.

Specific military applications of cobalt as identified by the Department of Defense include:

- Military jet aircraft engines and parts (F100, F101, F404, TF39, TF30, TF34, J79, TF33, TF56)
- Military aircraft structural components, fasterners, etc. (F-18's, F-16's, F-15's, F-14's, F-4's, A-10's)
- Helicopter engines, fasteners, flange bolts and structural components
- Missile components, cases, hardware and springs (Trident, Poseiden, Harpoon and Dragon)
- Space shuttle and space gyros
- Military armament solenoid controls
- Military tank precision rotating components and cannon recoil springs (M-60)
- Body of kinetic energy penetrator (M-735)
- Projectiles and projectile parts (armor piercing)
- Rocket engine cases and warheads

- Navigational equipment
- Propulsions systems (fossil and nuclear)
- Missile control parts and cases.

The Essential Nature of Cobalt

The U.S. Bureau of Mines in its publication "Cobalt" (October 1979) has identified cobalt as strategically and critically important because of its uses as:

- A component of the high temperature resistant alloy in jet engines
- A binder in cemeted carbides for metal cutting
- A binder in mining tools (drill bits, valves, and pipes), hard facing (valves, chain saws, shovel teeth, scrapers, etc.)
- A component of the alloys used for drawing and forming dies and rolls for the manufacture of steel
- A desulfurizing catalyst in refining and processing crude oil.

In many of its aplications, cobalt has no substitute; in its absence many key industrial and military products simply could not be produced. In recent Congressional testimony,[2] Mr. Gray, Chairman and Chief Executive of United Technologies Corporation, the largest U.S. defense contractor, identified cobalt as essential in defense production and specifically indicated military engines could not be built without cobalt.

According to a major U.S. jet aircraft engine producer, if high purity cobalt became entirely unavailable today, over 20 percent of the current U.S. military and commercial air fleet would become inoperable each year.[3] As the new generation of higher thrust-to-weight, cobalt rich engines on short haul aircraft arrives, the airfleet survival time would be shorter.

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[2] House of Representatives, House Armed Service Committee, September 17, 1980).

U.S. CONSUMPTION OF COBALT

The U.S. is the largest cobalt consumer in the world, consuming 1/4 to 1/3 of world production. In 1980, total U.S. consumption of cobalt was approximately 17 million pounds. This level of consumption is expected to increase at an annual rate of 5 percent over the period 1981-1990.

As previously noted, the defense sector presently accounts for 20-25 percent of cobalt consumption or from 3 to 5 million pounds annually. This level is projected to increase at an annual rate of 19 percent from 1981 to 1985. In a war-time situation, direct defense requirements would double.

THE VULNERABILITY OF PRESENT COBALT SUPPLIES

There has been no domestic primary cobalt production since 1971. Domestic secondary cobalt production (recycled cobalt) accounts for 5 to 7 percent of current supplies. Consequently, 93 to 95 percent of the U.S. cobalt supply is imported.

In 1979, 73 percent of the cobalt imported into the U.S. originated in the central African countries of Zaire (55 percent) and Zambia (18 percent). Exhibit 2 depicts the proportionate shares of U.S. cobalt imports by originating country. Since 1979 this pattern of imports has remained essentially unchanged.

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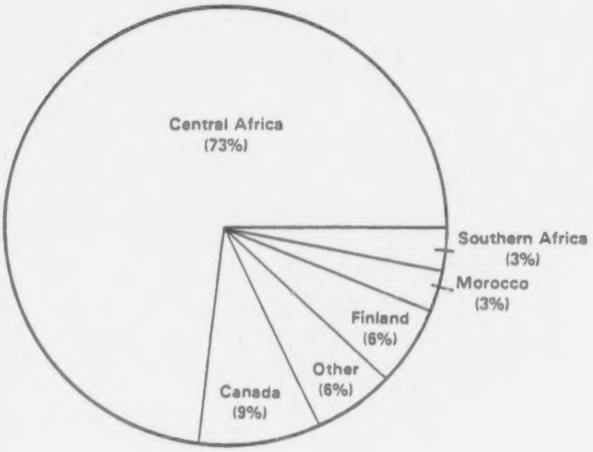
[3] Dr. William Owczarski, Manager, Technical Planning, Pratt & Whitney Aircraft Group, United Technologies Corporation (Materials Critical to the Aerospace Industry Workshop, Gaithersburg, Md., February 9, 1981).

Exhibit 2

U.S. Cobalt Suppliers, 1979
(Originating Countries)



The central African sources of cobalt supply, nearly three-fourths of U.S. imports, are relatively insecure. Political and economic problems within Zaire and Zambia, and between their neighboring countries are sources of this insecurity. Also contributing to this insecurity is the interdependence among the nations of this region for transportation routes and energy. As shown in Exhibit 3, the two major cobalt producers, Zaire and Zambia are bordered by 8 and 9 countries, respectively.

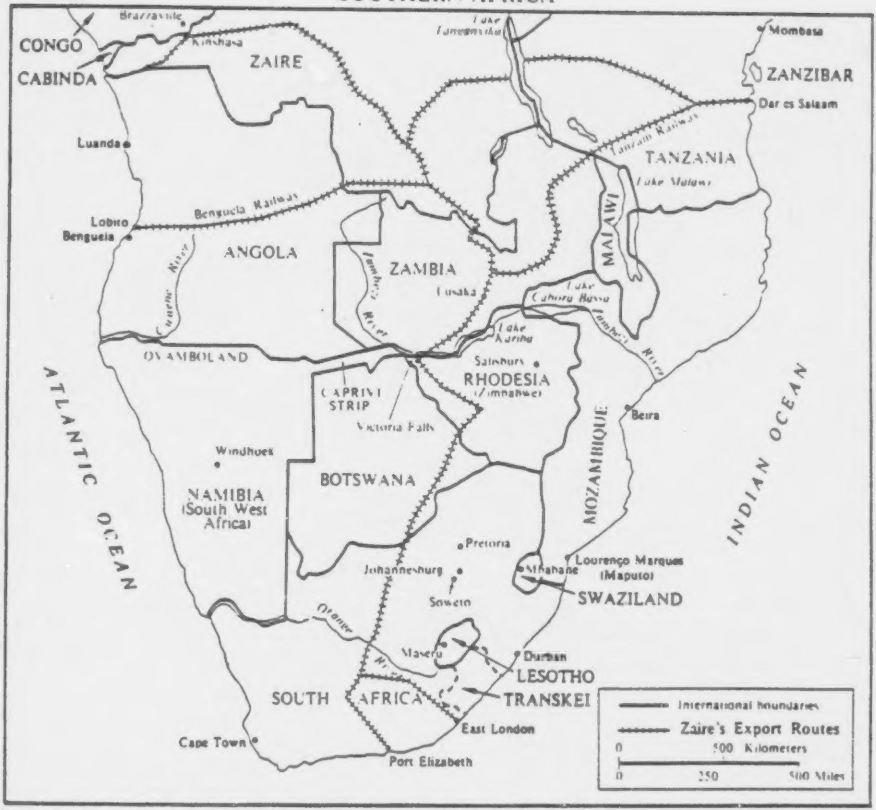
The continued capability of ground transportation to deliver cobalt exports to seaports is a critical factor in its supply. Because of political instabilities and transport interdependencies in the region, the security of ground transportation routes is continually threatened. The copper-cobalt mining districts of Zaire and Zambia are inland and require a several thousand mile trip through Zambia, Zimbabwe, and Botswana. These routes are limited and easily interdicted. For instance, the main railroad linking the mineral rich region of the Shaba Province of Zaire with the Port of Lobito in Angola was severed at several places as a result of civil strife in Angola which occurred in 1976. This rail link has not yet been restored. Zaire also has experienced insurgent attacks from Angola during 1977 and 1978 which disrupted copper and cobalt production. The threat of recurring attack remains.

Adding to the importance of maintaining ground transportation routes is the fact that cobalt is a by-product of copper production. Although at current high cobalt prices, air shipment is economically feasible, this is not the case for copper. Thus if copper could not be exported, production would cease. And, as a by-product of copper, so would the production of cobalt.

As shown in Exhibit 4, growing concentrations of communist military and civilian advisors in Zambia as well as countries surrounding Zaire and Zambia also sharpen the concern for supply disruption. Particularly important is the high concentration in Angola, bordering both Zambia and Zaire, estimated at 20,000 personnel. Further, ports on both the east and west coasts of Sub-Saharan Africa are open to Soviet naval forces.

Exhibit 3

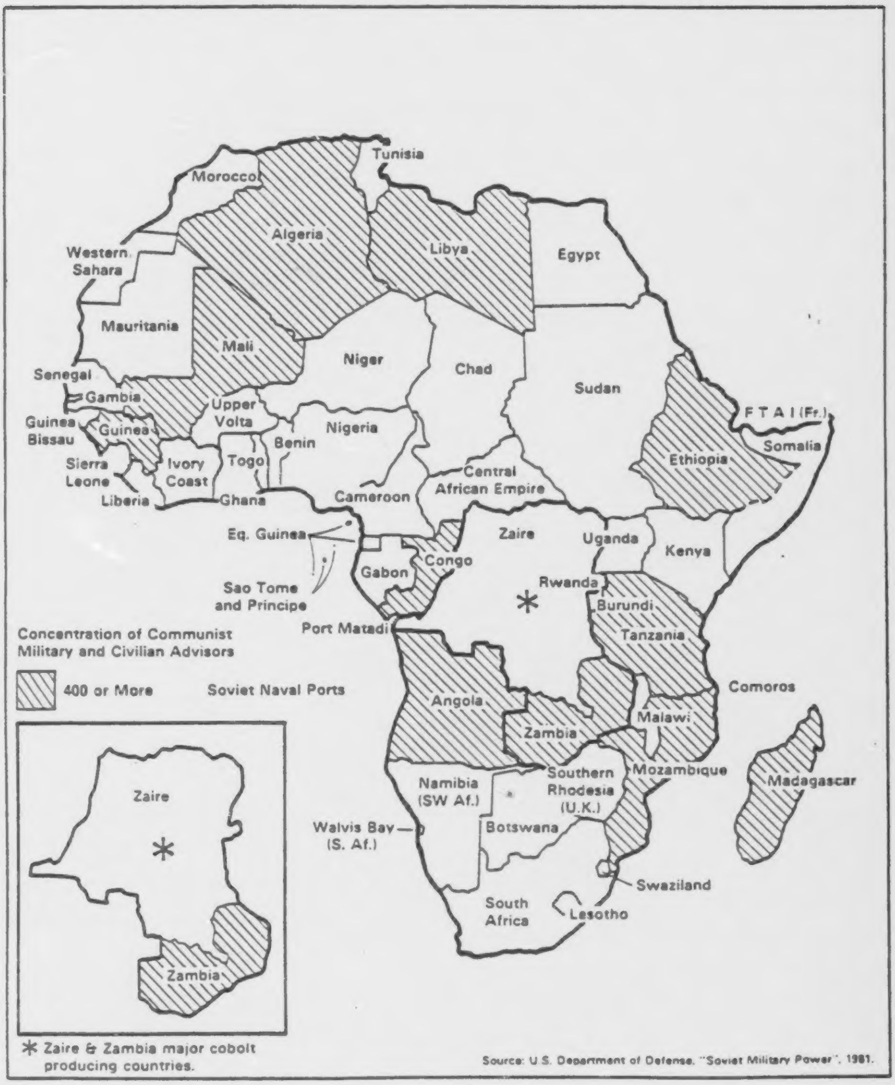
SOUTHERN AFRICA


Brazzaville
Kinshasa
CONGO
CABINDA
ZAIRE
Lake Tanganyika
Mombasa
ZANZIBAR
Dar es Salaam
Luanda
Tanzam Railway
TANZANIA
Lake Malawi
Lobito
Benguela
Benguela Railway
ANGOLA
MALAWI
ZAMBIA
Lusaka
Zambezi River
Cunene River
Lake Cabora Bassa
Zambezi River
Lake Kariba
OVAMBOLAND
Salisbury
RHODESIA
(Zimbabwe)
CAPRIVI STRIP
Victoria Falls
Beira
ATLANTIC OCEAN
INDIAN OCEAN
MOZAMBIQUE
Windhoek
NAMIBIA
(South West Africa)
BOTSWANA
Pretoria
Johannesburg
Soweto
Mbabane
Lourenço Marques
(Maputo)
SWAZILAND
Orange River
Maseru
Durban
LESOTHO
TRANSKEI
SOUTH AFRICA
East London
Cape Town
Port Elizabeth
International boundaries
Zaire's Export Routes
0
500 Kilometers
0
250
500 Miles

Source: International Institute for Strategic Studies, *Strategic Survey, 1976* (London, 1977), p. 45.

Exhibit 4

Concentrations of Communist Military and Civilian Advisors


Tunisia
Morocco
Algeria
Libya
Egypt
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Senegal
Gambia
Upper Volta
Guinea Bissau
Guinea
Benin
Nigeria
F T A I (Fr.)
Somalia
Ethiopia
Sierra Leone
Ivory Coast
Togo
Central African Empire
Liberia
Ghana
Cameroon
Eq. Guinea
Zaire
Uganda
Kenya
Gabon
Congo
Sao Tome and Principe
Rwanda
*
Burundi
Port Matadi
Tanzania
Concentration of Communist Military and Civilian Advisors
▨ 400 or More
Soviet Naval Ports
Comoros
Angola
Zambia
Malawi
Zaire
*
Namibia (SW Af.)
Southern Rhodesia (U.K.)
Mozambique
Madagascar
Walvis Bay (S. Af.)
Botswana
Swaziland
South Africa
Lesotho
Zambia

* Zaire & Zambia major cobolt producing countries.

Source: U.S. Department of Defense, "Soviet Military Power", 1981.

In addition to political factors, there are three additional characteristics of cobalt supply which threatens its stability. First, central African supplies are provided under the situations of a very limited availability of skilled labor and replacement parts for cobalt production equipment. Even a seemingly minor equipment sabotage could have a serious effect on the continuity of cobalt production. Second, the small size of the world market and the inability of producers to significantly increase supply in the short-run, is an additional source of vulnerability to cobalt users. An unexpected purchase, for example, of 5 million pounds represents 14 percent of world production, 25-30 percent of domestic consumption, and would result in a cobalt shortage for the rest of the market. Third, geographic metal refining and trade patterns particularly affect the vulnerability of U.S. cobalt supplies.

Cobalt mined outside of Central Africa is typically exported for metal refinement. A small portion of cobalt exported for refinement is processed in the United States, approximately 1-2 percent of world production. Japan and Western Europe, also major cobalt consumers, refine most of non-Central African produced cobalt. If a serious disruption of Central African cobalt supply occured, the U.S. could expect the major consuming (and refining) countries to meet their domestic needs before the needs of the export market, reducing U.S. supply still further.

In 1979, Zaire produced three-fifths of the world's supply of cobalt. The next largest producer, Zambia, produced only one-fifth of this amount, and the third largest producer, Australia, produced only one-tenth of this amount (see Exhibit 5). Significant reductions in this supply concentration are not expected within the next decade. This is , in part, a result of Zaire's market power. Zaire's cobalt is produced by one government-owned company. This centrally controlled production and marketing organization, complemented by lower production costs, permits Zaire to have substantial price-setting power. Price-setting power and lower production costs place unacceptably high

Exhibit 5

Cobalt Mine Production*
(Percent)

Country	Mine Production		
	1977	1978	1979
Zaire	40	40	59
Zambia	8	8	12
New Caledonia	16	15	1
Morocco	6	7	4
Australia	13	12	6
Philippines	4	4	5
Canada	6	6	5
Finland	5	6	5
Botswana	1	1	1
Other	1	2	2
TOTAL	100	100	100

* Does not include centrally planned economies.

SOURCE: Bureau of Mines, U.S. Department of Interior, Minerals Yearbook, Volume I, p. 257.

financial risks on new source development or capacity expansion, and reinforces the present concentration of supply.

This price setting power has been demonstrated in recent years. In 1978, following the disruption in Zaire, the "list" or producer price rose from $6.85 to $25.00 per pound. As cobalt demand slackened in 1979, price was not permitted to be lowered. In fact, price was maintained for two years despite the accumulation of very large cobalt inventories in Zaire. Such inventories are a threat to suppliers having higher production costs than Zaire's because they could be released to temporarily depress world prices, foreclose the entry of new suppliers, and "punish" new but higher cost suppliers.

IMPLICATIONS FOR DEFENSE PRODUCTION AND NATIONAL SECURITY

Cobalt is a vital and, in many instances, a non-substitutable input to defense and defense-related production. The tight cobalt supply situation in 1978-1979 demonstrated its criticality to aircraft engine parts production. As shown below, the production leadtime for aircraft parts containing cobalt doubled to nearly 2-1/2 years within 10 months.

LEADTIME
Months

	Cobalt Sheet Procurement	Cobalt Containing Parts Procurement
July 1978	5	14
October 1978	9	18
January 1979	15	24
April 1979	20	29

SOURCE: J.H. Willifort, Pratt & Whitney

More dramatically, Mr. Harry J. Gray, Chairman of the United Technologies Corporation, has stated in testimony before the House Armed Services Committee that military aircraft engines could not be built without cobalt.

Finally, as noted earlier, if high purity cobalt became unavailable, over 20 percent of the present U.S. military and commercial aircraft fleet would become inoperable each year for lack of cobalt-containing replacement parts.

III. FOUNDATION FOR THE DEVELOPMENT OF ALTERNATIVE SUPPLY PROTECTION POLICIES

This chapter describes the bases which exist to support the development of alternative supply protection policies. Following a description of the cobalt stockpile situation, alternative sources of cobalt supply are described. The chapter concludes with a description of existing legislation which could enable the development of these alternative cobalt supplies.

THE PRESENT STOCKPILE SITUATION

Cobalt is held in the National Defense Stockpile under the authority of the Strategic Materials Stock Piling Act, as amended. The purpose of the Act is to provide for the acquisition and retention of stocks of certain strategic and critical materials, and to encourage development of sources of such materials in the U.S. to decrease or preclude U.S. dependence upon foreign sources for such materials in time of a national emergency.

The National Defense Stockpile goal for cobalt, the difference between estimated wartime requirements and supply, has been approximately 85 million pounds since 1976. The estimated wartime requirements for cobalt increases 150 to 200 percent of normal requirements and the projected supply is assumed to be less than 20 percent of the normal supply. Defense requirements for cobalt represent 56 percent of total emergency requirements, and approximately two-thirds of the defense requirements are for aircraft engines and replacement parts.

A stockpile acquisition program is currently underway at the direction of the President, and cobalt was selected to be the first major purchase in 20 years. When the current procurement of 5.2 million pounds is delivered, a short-fall of approximately 40 million pounds will remain.

ALTERNATIVE SOURCES OF SUPPLY

There are two alternative sources of cobalt supply: domestic and international deep-sea.

Domestic Resources and Reserves

Although domestic mine production has not occurred since 1971, domestic identified resources, i.e., cobalt concentrations that are technically recoverable, are extensive. The U.S. Bureau of Mines has identified resources estimated at 1.4 billion pounds. The portion of identified resources that can be economically extracted, the reserve base, was estimated in 1980 to be 209 million pounds. At prices ranging up to $25 per pound, it is economically feasible to extract 72 percent of this reserve base. These figures are not static and vary with price, exploration, and technology. In fact, according to recent testimony by the U.S. Geological Survey, domestic resources are potentially quite large. While only deposits in Idaho, Missouri, Oregon-California, and Minnesota are capable of producing cobalt in the near future, there is an excellent potential for finding as yet undiscovered, important deposits.[4]

The price of cobalt did not attract domestic resources development until 1978. In that year, the price of cobalt rose from $6.85 per pound to $25 per pound, and remained at that level until February of 1981. Downward price adjustments were made several times since then. As of February 1982, the price was approximately $15 per pound. The continuation of these relatively high prices has encouraged planning for the development of domestic higher grade deposits.

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[4] Testimony of Dr. Michael Foose, U.S. Geological Survey, before the Senate Committee on Banking, Housing, and Urban Affairs, October 26, 1981.

Plans to reopen cobalt mines in Blackbird, Idaho and Fredericktown, Missouri, to develop a mine in the Gasquet Mountains area of California, and a cobalt recovery project have been considered by Noranda, Hanna, Anschutz, California Nickel, and AMAX mining companies, respectively. In fact, the companies have prepared extensive mining and refining feasibility and cost studies, developed much of the necessary mine infrastructure, and obtained many of the necessary environmental permits.

Domestic cobalt production plans and potential are described in Appendix A. Production information on these resources is summarized in Exhibit 6.

By 1985 approximately 9 million pounds of cobalt could be produced from these sources. By 1990, an additional five million pounds could be produced annually. According to a recent Bureau of Mines study, at current cobalt, copper and nickel prices, over half of domestic requirements in 1990 could be met with existing domestic production potential.

Domestic cobalt production plans, however, remain tentative. Domestic cobalt mining and refining is characterized by large fixed investments and high risk exposure. To produce cobalt domestically from the higher grade domestic resources, a minimum investment of $100 million is required for a two million pound per year operation. Because domestic cobalt production is economically feasible only with the higher prices of recent years, the possibility of further major price reductions renders these investments very risky. Zaire has the capability to lower the world price below the domestic break even point and still make a profit over their production costs.

Exhibit 6

U.S. COBALT RESERVES AND POTENTIAL PRODUCTION

Resource Location, Ownership	Ore Content (%)		Reserves Mil. Lbs. Metal	Annual Production (Mil. Lbs. Metal)	Production Initiation Year
Blackbird, Idaho (Noranda, Hanna)	Co	.71	77	3-4	1985
	Cu	1.24	134	8-9	
Gasquet Mountain, Calif. (California Nickel)	Co.	.10	70	2.6	1984
	Ni	.87	640	27	
	Cr	2.	1460	140 1/	
Madison, Missouri (Anschutz)	Co	.24	29	2	1985
	Ni	.34	39	2.6	
	Cu	.45	63	4.2	
Duluth-Gabro (Amax, Inco)	Co	.01		2	1990
	Ni	.87		40	
Braitwait, Louisiana 2/ (Amax)				3	1990

1/ In the form of concentrates, 40 percent chromite by weight.

2/ Expand and upgrade existing facilities to recover cobalt from lead and zinc production and tailings.

Domestic producer plans for refinery investment are also tentative. High purity cobalt metal refining investment costs represent approximately 66-75 percent of total investment costs. The required investment for extracting the ore represents the remaining 25-33 percent. If domestic producers commit their resources to extraction and choose not to invest in a refinery, but to have the cobalt refined overseas, or to produce a concentrate, U.S. strategic vulnerability remains. Overseas refining imparts much the same supply risks as non-Central African supply does today. The major cobalt refiners, Japan and Western Europe, are also major cobalt consumers. If a serious disruption of Central African cobalt supply occurred, the U.S. could expect these countries to meet their domestic needs before the needs of the export market.

International Source - North Pacific Ocean

Deep-sea manganese nodules are a significant, long-term potential source of cobalt. Although nodules would not provide the supply security of the domestic source, substantial diversification of supply could result. The ocean floor nodules range from pea to baseball in size and contain significant quantities of cobalt averaging (0.235 - 0.35 percent), nickel (1 percent), copper (1 percent), and manganese (24 percent). Potential annual recovery is estimated at 40 million pounds of cobalt, 337 million pounds of nickel, 270 pounds of copper and 3750 million pounds of manganese.

Political problems concerning international ownership and licensing remain and are debated at periodic sessions of the United Nations Law of the Sea Conference. In 1980, the U.S. Congress passed the Deep Seabed Hard Minerals Resources Act (PL 96-283), providing for exploration licensing and commercial mining after 1987.

In addition to international agreements yet to be reached, the commercial viability of deep seabed mining is uncertain. Production could begin, according to industry sources, as early as 1990, but is unlikely until 2000.

EXISTING LEGISLATION

The Defense Production Act of 1950 provides an existing legislative basis for the development of alternative cobalt supply protection policies. It was enacted to insure domestic productive capacity in the event of an attack on the U.S. by encouraging the exploration, development and mining of critical and strategic materials. Title III of the Act authorizes the government to make commitments to purchase and establish floor prices for certain critical materials (thereby reducing the otherwise considerable financial risks to an acceptable level), offer low interest or guaranteed loans, or allow accelerated writeoffs of capital investment.

The cost to the government of a production incentive, relative to the cost of stockpiling, the criticality of the material to defense production and the vulnerability of supply sources are primary considerations in using Title III. The method selected to encourage domestic production is influenced by the structure of the industry, available domestic resources, feasibility and timing of potential production projects, and the current technology associated with the specific material.

The domestic production incentive selected for detailed economic and budgetary impact analysis is a guaranteed floor price. Initially, purchase price commitments, low interest loans, and capital grants were considered. Participating producers of cobalt, under this incentive, would share the financial risk of plunging market prices while government exposure and market presence are minimized. However, if alternative incentive(s) and/or production projects surface that are more advantageous to the Federal government and national security objectives before program implementation, these alternative(s) could be selected for implementation.

IV. EVALUATION OF ALTERNATIVE SUPPLY PROTECTION POLICIES

The economic and federal budgetary impacts of stockpiling and alternative programs of domestic production incentives with lower required stockpiling are considered in this section. The level of national security provided by each alternative is equivalent to a strategic stockpile inventory of 85.4 million pounds, the current stockpile goal. The increase in secure supply provided by domestic production lowers the required stockpile purchases. The alternatives vary from a purchase of 4.5 million pounds of cobalt for ten years with no domestic production, to a ten million pound domestic capacity supplemented by stockpile purchases of 1.4 million pounds per year. Economic constraints, as estimated by the Bureau of Mines, hold feasible domestic production to ten million pounds per year.

ASSUMPTIONS

The economic and budgetary effects of the options selected are evaluated under two sets of assumptions about the world cobalt situation. The first is a continuation of normal markets. The second is a peacetime production interruption of the largest U.S. and world cobalt supplier, Zaire. It is assumed that this disruption affects 50 percent of the normal U.S. supply. In addition, to non-Zairean production available during the disruption, a supply of world producer stocks, equivalent to 3-1/2 months of western world consumption, are available to cobalt consumers.

Export controls and required time paths for trade pattern adjustments are not included in disruption impacts and could be substantial. In the event of a complete interruption of Zaire shipments, Western Europe and Japan would represent 51 percent of the remaining refining capacity. The U.S. could expect both Japan and Western European countries, as major cobalt consumers, to meet their domestic cobalt needs before the needs of the export market.

The econometric forecasts of consumption and market price for each policy option include planned foreign cobalt capacity expansions and dominant producer output behavior. The timeframe of the analysis is 1981 through 1990.

SELECTED POLICY OPTIONS

The following options were selected for evaluation:

- Stockpile purchases of 44.6 million pounds over a ten year period with no domestic primary production (stockpile only).
- Stimulation of 5 million pounds annually of domestic primary production beginning in 1984 and supplemented with stockpile purchases of 29.2 million pounds over the 10 year period (Hybrid 1).
- Stimulation of 7 million pounds annually of domestic primary production and stockpile purchases of 23.6 million pounds over the ten year period (Hybrid 2).
- Stimulation of ten million pounds annually of domestic primary production and stockpile purchases of 14.2 million pounds over a ten year period (Hybrid 3). Ten million pounds is the maximum economic domestic production as estimated by the Bureau of Mines.

Each option provides for a level of material availability equivalent to a strategic stockpile of 85.4 million pounds.

To stimulate domestic production, a government-guaranteed minimum price is made for the first five years of domestic production. Participating producers would be paid the difference between the market and guaranteed price for guaranteed output when the market price falls below the guaranteed price. Domestic production is initiated in 1984, stockpile purchases begin in

1981. All cobalt purchased for the strategic stockpile is through open market acquisition. During the 1985 disruption, a stockpile release equivalent to 25 percent of projected consumption is made. While additional materials might be released from the stockpile during an actual disruption, this proportion approximates peacetime direct defense requirements. The year following the disruption, no stockpile purchases are made.

CRITERIA FOR EVALUATION

Each option was evaluated using two criteria against a base case of no change in cobalt supply: 1) the net economic benefits produced over the ten year planning period; and 2) the federal expenditure requirement. These values were computed for a normal market situation and a 1985 supply disruption. Net economic benefits are the differences between gross benefits and gross costs. Gross benefits consist of the value of cobalt consumed at the market price plus the "consumer surplus," the additional economic value placed on the quantity consumed not reflected in the market price. Gross costs consist of import costs plus the cost of production of any domestically produced supply.

ANALYTICAL APPROACH

Economic forecasts of consumption and market price for each policy option and scenario (normal and disrupted supply) were made by the Office of Commodity Policy (OCP), Department of Commerce. Based on data for the period 1962-1979, noncentrally planned cobalt supply and demand estimates were made. The demand side of the model includes U.S. demand and, because of data limitations, the rest of the western world in aggregate. The U.S. sector includes eight end use sectors. In a historic simulation, the model replicates U.S. consumption from 1962 thru 1979 with a mean absolute error of 5.9 percent.

The supply side of the model includes individual supply equations for the five leading cobalt mining countries and the rest-of-world. Planned foreign cobalt capacity expansion and dominant producer output behavior are included in the OCP supply forecasts. As the dominant producer, Zaire attempts to maximize its long-run revenue through inventory adjustment. Producers other than Zaire sell all their output at the market prices set by Zaire. The recent Zairean inventory drawdown of 1975-1976 and inventory buildup of 1980-1981 are supportive of this assumed behavior. (This buildup reached an estimated 35 million pounds, approximately equivalent to 1.4 times its annual production level.) The modeled supply reproduces overall historic production levels with a mean absolute percent error of 5.6 percent for the 1962-1979 period.

Increased domestic production and GSA purchases are exogenous policy variables that may affect price and consumption. Because of the by-product nature of cobalt and Zaire's marketing behavior, however, increased domestic production is not expected to reduce non-Zairean production or current expansion plans.

The economic costs of a shortage are both direct and indirect. Direct costs, are dollar costs associated with the importation of cobalt plus the purchase cost of any domestically produced supply. Losses of production in end use sectors are indirect costs. The indirect costs of a shortage are important and are expected to be larger than direct costs. Cobalt, like most strategic materials, is not a discretionary input in most applications and, in terms of final output value, cobalt is a small fraction. These indirect costs of a cobalt shortage, i.e., value of lost output, have not been measured in this analysis. However, consumption, or maintenance of consumption, may be considered an ordinal proxy or indicator of these indirect costs which can be expected to rise as cobalt consumption declines.

Net direct economic benefits are the difference between the gross economic benefits and costs of a policy option, measured as change from the "No Policy" baseline projection. Gross economic benefit includes consumer surplus and the value of consumption to consumers. Gross direct economic cost components are foreign transfers and the domestic resource cost (the cost of purchasing cobalt domestically). Appendix C provides additional detail on methodology of measurement and definitions of components. Net economic benefits are estimated for each year of the period 1981-1990 in constant dollars. Future benefits are, however, in an economic sense, worth less than benefits received in the present. Consequently, the net benefit accrued each year is then discounted back to 1981 at a rate of 10 percent compounded annually (OMB Circular A-94, Revised) to adjust future benefits to present value.

Budgetary costs include acquisition costs and domestic production incentives. Acquisition costs are stockpile purchases, made on the open market, at forecast prices. Production incentive costs are estimated for a range of floor prices. The lower end of the cost range reflects a floor price of $15 per pound, an average cobalt price required to provide a 15 percent discounted cash flow rate of return of the most economic domestic deposits, totaling 10 million pounds production per annum, according to a recent Bureau of Mines Study. The top of the cost range reflects the necessary floor price level specified by two potential cobalt producers in recent Congressional testimony. Floor prices of $20 (three-fifths of guarantee) and $25 (two-fifths of guarantee) are used to compute the upper end of the cost range. Program length is limited to five years to reflect contingent liability limitations placed on past Title III funded projects. Contractually specified, contingent liability limits the cost to the government of canceling a contract to the value of the undepreciated capital required to produce, in this case, cobalt.

RESULTS OF THE ANALYSIS ASSUMING NO DISRUPTION

Exhibits 7 and 8 project U.S. cobalt consumption and prices for the period of 1981-1990 on the assumption of no supply disruption. Values are shown for each of the four policy options and for the no policy situation. Each of the three Hybrid options (i.e., those involving some amount of domestic primary production) result in higher cobalt consumption beginning around 1985 relative to the "Stockpile Only" and "No Policy" options. The "Hybrid" options are also projected to result in generally lower cobalt prices in the same period. The "Stockpile Only" option results in the lowest consumption levels and highest prices because of the upward shift in cobalt demand caused by stockpile purchases.

Exhibit 9 summarizes the direct economic net benefits and federal outlays measured as changes from the "No Policy" baseline projection.

The following paragraphs describe the projected impacts of each of the four options, assuming no disruptions in supply.

Stockpile Purchase Only

The stockpile is filled in ten years at a constant acquisition rate of 4.46 million pounds per year. Foreign transfers increase by $1 billion as a result of the increases in demand caused by the stockpiling and their upward effects on price. The net economic benefit is $-1.2 billion over the ten year period, and federal outlays are estimated at $1.1 billion. On the average, price is 16 percent higher and industrial consumption 5 percent lower than in the absence of building the stockpile. Both values are relatively stable with increasing trends.

Hybrid 1. A Federal Government floor price guarantee results in 5 million pounds of domestic production, 24 percent of anticipated U.S. cobalt consumption at production initiation. The annual quantity of GSA acquisition is 2.92 million pounds. Domestic consumption approximates the "No Policy" level.

Exhibit 7

Alternative Policies U.S. Cobalt Consumption 1981-1990

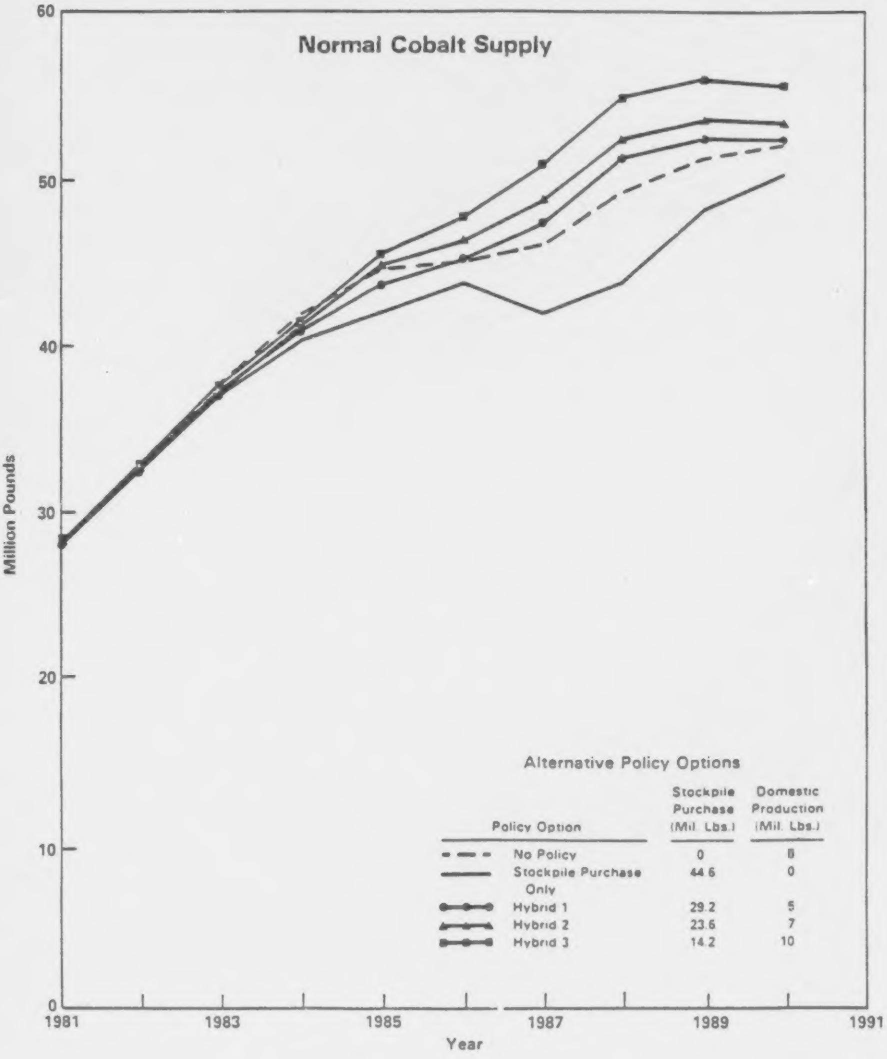


Exhibit 8

Alternative Policies Cobalt Price 1981-1990

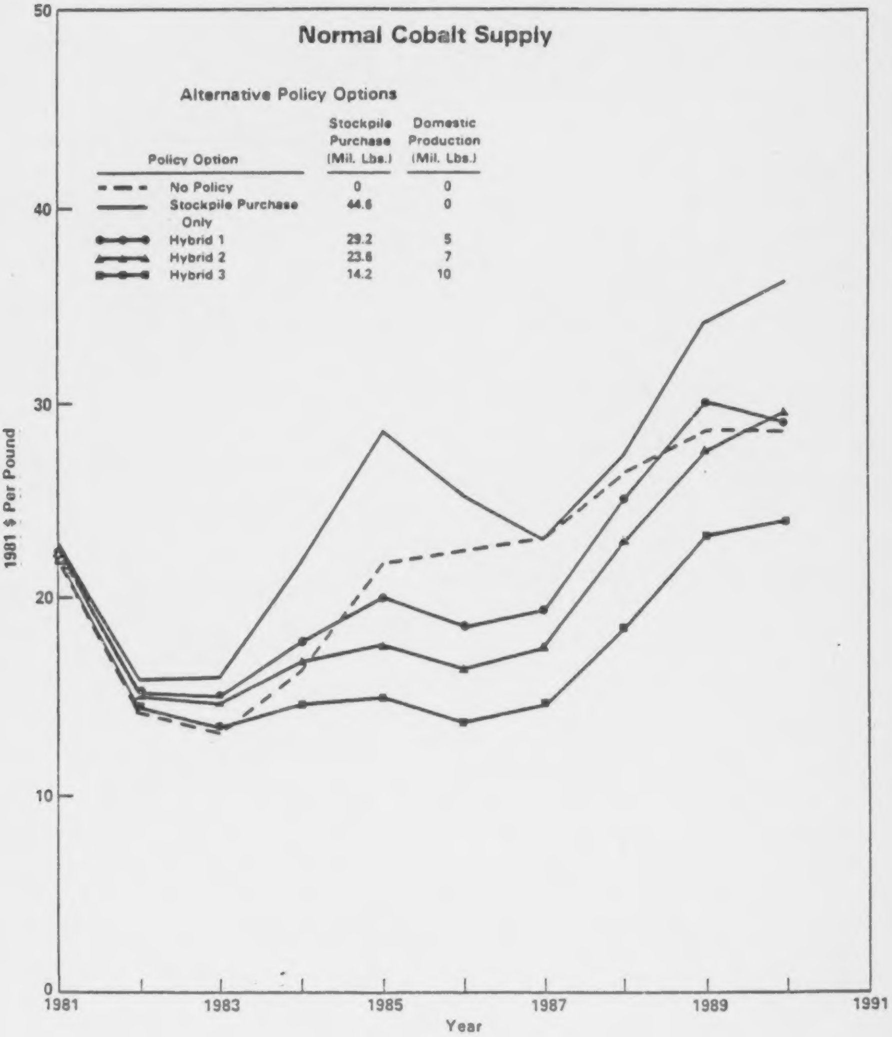


Exhibit 9

Normal Cobalt Supply
Direct Economic Net Benefits and Federal Outlays 1981-1990
(Million 1981 $)

	Strategic Stockpile and Domestic Production Policy Alternatives				
	No Policy	Stockpile Only	Hybrid 1	Hybrid 2	Hybrid 3
Domestic Production (Million Pounds/Year)	0	0	5	7	10
Stockpile Purchase (Total — Million Pounds)	0	44.6	29.2	23.6	14.2
Direct Economic Benefit (10% Discounted Present Value)					
Gross Benefit	0	-148	-2	85	133
Gross Cost (Range)	0	1028	217 to 358	-14 to 183	-392 to -110
Net Direct Economic Benefit (Range)	0	-1176	-360 to 219	-98 to 99	244 to 525
Federal Government Outlays					
Stockpile Acquisition	0	1122	621	473	246
Floor Price (Cost Range)	0	0	0 to 21	0 to 39	0 to 192
Total Outlays	0	1122	621 to 645	473 to 519	246 to 474

Discounted foreign transfers are reduced by $84 million in the first seven years of domestic production. However, the total estimated domestic cobalt production or "resource" cost negates these benefits. The average net economic benefit is $-70 million, a 94 percent improvement from stockpiling alone. The maximum annual budgetary impact for a five-year purchase price guarantee is 7.4 million. Total budgetary authority required for the five-year floor price guarantee ranges from $0 to $21 million. Stockpile acquisition costs are the major expense, totaling $621 million. Combined production incentive and acquisition costs are estimated at $621-$645 million.

Hybrid 2. A Federal Government guaranteed floor price for five million pounds results in an annual domestic production of seven million pounds, 34 percent of anticipated U.S. cobalt consumption at production initiation. The annual stockpile acquisition is 2.36 million pounds, totaling 23.6 million pounds in the non-disruption case. The net increase in supply, as in the five million pounds production case, lowers price, on average by 11 percent from that of the "No Policy" option. Consumption, however, increases by only three percent, indicating the non-discretionary nature of the material. Foreign transfers are reduced by $437 million from the "No Policy" case. The estimated domestic resource cost, however, largely negate these benefits. Average net economic benefits are $ .5 million lower than the "No Policy" case and represent a $1.2 billion dollar reduction in costs from the "Stockpile Only" option. The maximum annual budgetary cost for the production incentive is $13 million. Total budgetary cost of the five-year incentive is estimated to range from $0 to $39 million. Stockpile acquisition costs are the major expense, totaling $473 million. Total combined costs are estimated at $473-$513 million.

Hybrid 3. A Federal Government guaranteed floor price for 10 million pounds results in an annual domestic production of 10 million pounds, 48 percent of anticipated U.S. consumption at production initiation. The annual GSA acquisition is 1.42 million pounds, totaling 14.2 million pounds in the non-disruption case. The net increase in supply results in a lower average cobalt price and slightly higher consumption compared to the "No Policy" scenario.

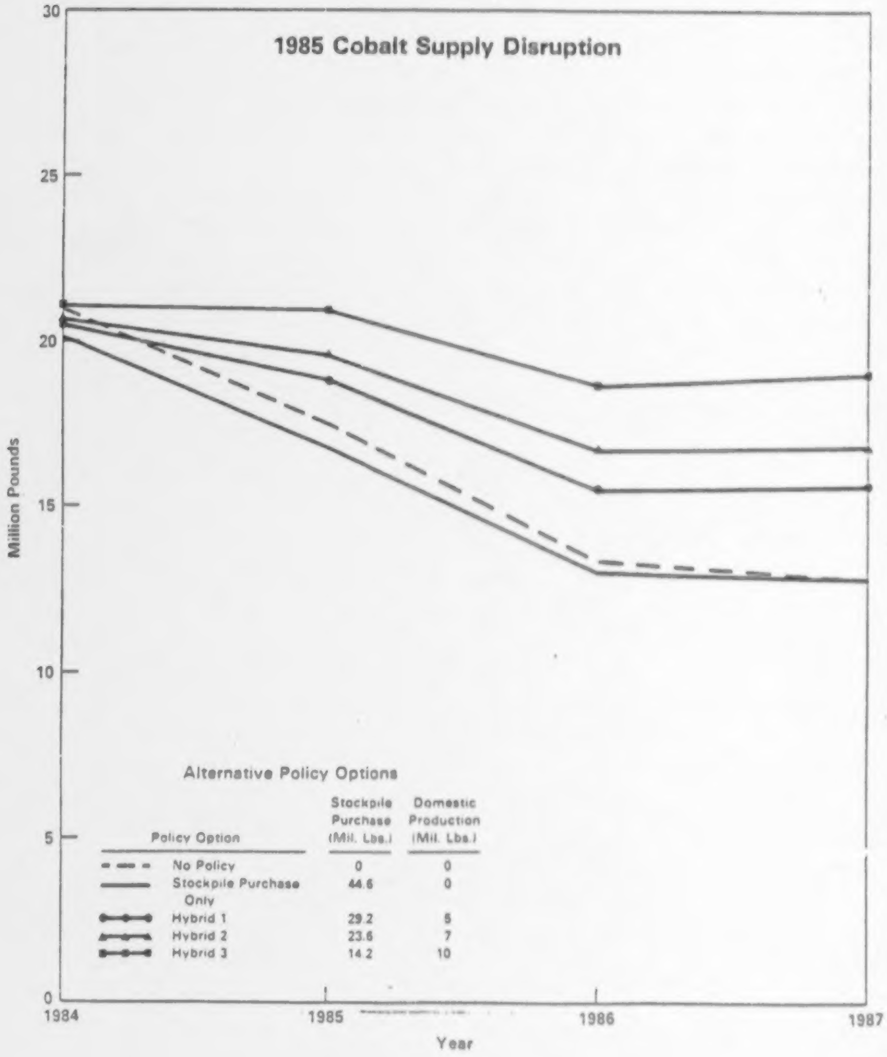
Domestic resource costs are the highest of the options considered, estimated at $604 to $885 million. However, total economic costs are more than offset by estimated benefits, primarily through reduced foreign transfers. Foreign transfers are reduced from the "No Policy" by $996 million. The net direct economic benefits from 10 million pounds of domestic production range from $244 to $525 million in the non-disruption case, compared to the $-1.2 billion net direct economic benefit estimated in the "Stockpile Only" option. The maximum annual cost of the production incentive is $38 million. Total budgetary outlays over the five-year program range from $0 to $192 million. Stockpile acquisition costs total $246 million. Combined production incentive, and acquisition costs are estimated at $246 to $474 million.

RESULTS OF THE ANALYSIS ASSUMING A DISRUPTION

Exhibits 10, 11, and 12 project absolute and percentage reductions in cobalt consumption, and increases in price assuming a Zaire cobalt supply disruption in 1985. In the absence of any policy, the 1985 disruption results in a price increase of almost fifteen-fold over the "No Policy" 1985 no disruption price. While dramatic, this change appears realistic when compared to the recent 1978 experience. Shortly after the Zairean-imposed cobalt consumption allocation, the U.S. cobalt price rose as high as ten-fold. The soaring disruption price, as a shortage allocation mechanism, enables the U.S. to maintain a high level of consumption despite the supply disruption. Two years following the disruption, price plummets to nearly $7 and begins to rise four years after the disruption.

Exhibit 10

U.S. Cobalt Consumption 1984-1987



Policy Option	Stockpile Purchase (Mil. Lbs.)	Domestic Production (Mil. Lbs.)
- - - No Policy	0	0
—— Stockpile Purchase Only	44.6	0
●—● Hybrid 1	29.2	5
▲—▲ Hybrid 2	23.6	7
■—■ Hybrid 3	14.2	10

Exhibit 11

Effectiveness of Alternative Supply Protection Policies
Cobalt Supply Disruption

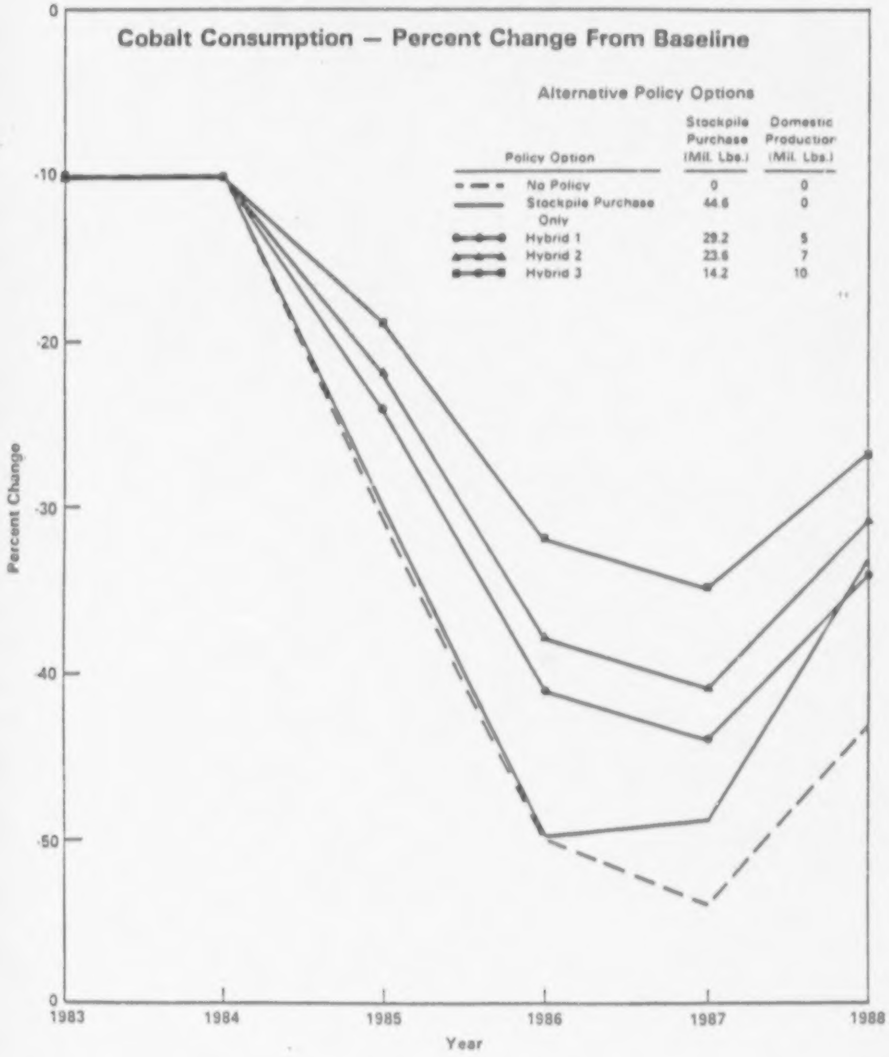
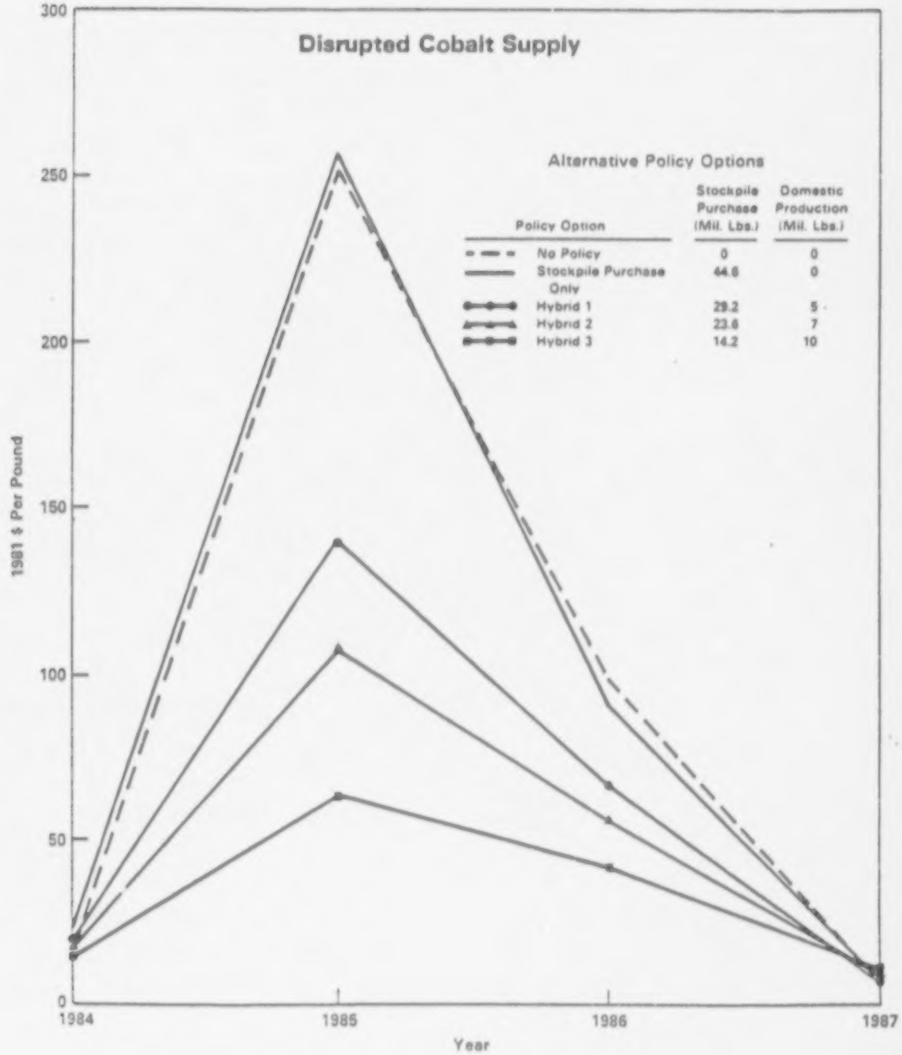


Exhibit 12

Cobalt Price



While world production is reduced by 56 percent in the disruption year, U.S. consumption falls by only 21 percent. However, the cobalt market may not operate under a system of pure economic bidding in the event of a supply disruption as the market model results suggest. An analysis of international cobalt processing and trade flows indicates that this market model may seriously understate the impacts on U.S. cobalt consumption resulting from a disruption of Zairean supplies. Exhibit 13 compares cobalt processing and trade flows under normal and disrupted conditions. With a shut-down of Zairean production, world production and refining falls to 61 percent of normal supply, with other producing and refining countries increasing their activities in response to the shortage. Although world cobalt production is estimated to fall by 39 percent, U.S. consumption is reduced by 50 percent. This disproportionate reduction is caused by two factors. First, aside from Zambia, other cobalt producing countries do not have significant refining capacity and export primarily cobalt ore. Second, ore importing countries, unlike the U.S., have substantial refining capacity and are also major cobalt consumers. The other major cobalt consumers, Japan and Western Europe, are also major world cobalt refiners. As such, they could be expected to absorb these ore exports to a greater degree than the U.S., reducing its supply by 50 percent. Governments of major cobalt refiners may also place controls on exports in order to preserve their industrial production. If export controls are imposed by Japan and Western Europe, U.S. supply would be reduced by 65 percent.

Returning to the market model results, supply is resumed during the year following the disruption, but consumption continues to decline to 60 percent of the non-disrupted supply level. Consumption begins to recover the third year following the disruption.

Exhibit 13

Cobalt Processing and Trade Flow 1985 Normal and Disrupted Supply

Normal Supply

Mine Production	(%)	Refining	(%)	Consumption	(%)
Zaire	50	Zaire	51	U.S.	26
Zambia	16	Zambia	14		
Other	22	Japan	8	Japan	16
		Western Europe	13	Western Europe	32
		Other	6	Other	11
CPE	12	CPE	8	CPE	15
Total	100		100		100

Disrupted Supply (Zaire Production)

Production	(%)	Refining	(%)	Consumption*	(%)	Reduced Consumption By Country*	(%)
Zaire	0	Zaire	0	U.S.	13	U.S.	50
Zambia	22	Zambia	20				
Other	27	Japan	12	Japan	12	Japan	25
		Western Europe	15	Western Europe	19	Western Europe	40
		Other	6	Other	5	Other	55
CPE	12	CPE	8	CPE	12	CPE	20
Total	61		61		61		

*Based on current material processing and trade patterns

Direct economic costs of the disruption are estimated at $3.89 billion. Most of the costs are foreign transfers, occuring during the disruption year. Exhibit 14 summarizes the direct economic net benefits and Federal outlays measured as changes from the "No Policy" baseline projection.

Stockpile Purchase

During the disruption, a stockpile release of 25 percent of normal annual consumption is made to ensure that direct defense production is maintained. Approximating the "No Policy" case, consumption drops by 20 percent during the disruption and 40 percent the following year. No acquisitions are made during the disruption year or the following year. Price, during and following the disruption, approximates that of the "No Policy" level.

The expected effects of a stockpile release on consumption and price are greatly reduced by the effects of the purchase program, and approximate those of the "No Policy" case. In the "No Policy" scenario, upward pressures on cobalt prices resulting from a disruption are somewhat dampened by inventory drawdowns. However, stockpile purchases would be of sufficient size to cause inventory reductions prior to the supply disruption with already upward pressure on prices and a reduced disruption buffer available with the higher inventories existing in the "No Policy" case. The basic cause of this is the by-product nature of cobalt. Cobalt production bears a fairly fixed relationship to the production of the metals from which it is extracted, mainly copper and nickel. Further, the value of the cobalt produced is only a small percentage of the revenue accruing to the mining operation. Consequently, even dramatic increases in the price of cobalt do not provide a return to producers sufficient to overcome the costs of the large primary metal inventories (or supply gluts) that would necessarily result from increased cobalt production. This supply inelasticity is responsible for the modest effects on price and consumption of a stockpile release during the supply disruption.

Exhibit 14

Zaire Cobalt Supply Disruption
Direct Economic Net Benefits and Federal Outlays 1981-1990
(Million 1981 $)

	Strategic Stockpile and Domestic Production Policy Alternatives				
	No Policy	Stockpile Only	Hybrid 1	Hybrid 2	Hybrid 3
Domestic Production (Million Pounds/Year)	0	0	5	7	10
Stockpile Purchase (Total — Million Pounds)	0	30.7	18.34	13.86	6.34
Direct Economic Benefit (10% Discounted Present Value)					
Gross Benefit	-1631	-1694	-1189	-1042	-849
Gross Cost (Range)	2256	1815	307 to 447	-68 to 129	-530 to -248
Net Direct Economic Benefit (Range)	-3887	-3509	-1636 to -1495	-1171 to -973	-600 to -319
Change in Net Benefits From "No Policy" (Range)	0	378	2251 to 2392	2716 to 2914	3287 to 3568
Policy Effectiveness Rank	5	4	3	2	1
Federal Government Outlays					
Stockpile Acquisition	0	-774	-373	-264	-169
Floor Price (Cost Range)	0	0	54 to 121	49 to 120	80 to 244
Total Outlays	0	-774	-319 to -242	-215 to -134	-89 to 102

The direct net economic benefits of this option, expressed as a reduction in the costs of a disruption with no policy, is $380 million, resulting in a remaining disruption cost of $3.5 billion. Because material released from the stockpile is sold by the government at prices prevailing during the disruption, federal outlays are negative, $-774 million.

Hybrid 1

Annual domestic production of five million pounds begins one year before the disruption and is supplemented by a stockpile release during the disruption. Stockpile acquisitions are not made in the disruption year or the year following the disruption. Shortage effects on consumption seen in the "No Policy" and "Stockpile Only" options are reduced by 33 percent during the disruption year and by 23 percent the following year. The price of cobalt reaches $141 per pound during the disruption, 45 percent lower than in the absence of policy or with stockpiling alone.

The direct net economic benefits of this option, expressed as a reduction in the costs of a disruption with no policy, is $2.3 billion, resulting in a remaining disruption cost of $1.6 billion. Federal outlays for the five year cobalt production price guarantee program range from $54 to $121 million. Although stockpile sales are made at prices which are 45 percent lower than in "Stockpiling Only," they are sufficient to produce negative net federal outlays in the range of $-215 to $-134 million.

Hybrid 2

Annual domestic production of seven million pounds begins one year before the disruption and is supplemented by a stockpile release during the disruption. Stockpile acquisitions are not made in the disruption year or the year following the disruption. Shortage effects on consumption seen in the "No Policy" and "Stockpile Only" options are reduced by 43 percent during the year and by 30 percent the following year. The price of cobalt reaches $107 per pound during the disruption, 58 percent lower than in the absence of policy or with stockpiling alone.

The direct net economic benefits of this option, expressed as a reduction in the costs of a disruption with no policy, is $2.8 billion, resulting in a remaining disruption cost of $1 billion. Federal outlays for the five year cobalt production price guarantee program range from $49 to $120 million. Although stockpile sales are made at prices which are 58 percent lower than in "Stockpiling Only," they are sufficient to produce negative net federal outlays in the range of $-215 to $-135 million.

Hybrid 3

Annual domestic production of 10 million pounds begins one year before the disruption and is complemented by a stockpile release during the disruption. Stockpile acquisitions are not made during the disruption year or the year following the disruption. Shortage effects on consumption seen in the "No Policy" and "Stockpile Only" options are reduced by 57 percent during the disruption year and by 45 percent the following year. Price of cobalt reaches $65 per pound during the disruption, 75 percent lower than in the absence of policy or with stockpiling alone.

Direct economic costs of the disruption are estimated at $.3 to .6 billion, 83 to 92 percent lower than the "Stockpile Only" option. Falling post disruption prices result in increased federal outlays are made for the five million pounds (seven million pound capacity) in for cobalt production price guarantees. During the five-year program, average annual production incentive outlays range from $80 to $244 million. Net budget outlays range from $-89 to $102 million. Budget outlays may be negative because receipts from stockpile releases more than offset acquisition costs and may also offset any production incentive costs. However, disruption price is the lowest of any policy considered, 75 percent lower than under "Stockpile Only." Federal revenue from stockpile releases are, thus, also lowest.

The direct net economic benefit of this option, expressed as a reduction in the costs of a disruption with no policy, is 3.4 billion, resulting in a remaining disruption cost of $.4 billion. Federal outlays for the five-year cobalt production price guarantee program range from $16 to $49 million. Although stockpile sales are made at prices which are 75 percent lower than in "Stockpiling Only," they are sufficient to produce negative net federal outlays in the range of $-102 to $-89 million.

LIMITATIONS OF THE ANALYSIS

There are two important limitations of this analysis which further enhance the basis of the above recommendation. The first limitation is the use of cobalt market prices as a measure of the economic value of cobalt. If a cobalt shortage occurred, the normal level of industrial cobalt consumption could be met. Cobalt is a vital component in most applications, and although it is a very small part of the final product value, unavailability of cobalt could result in significant industrial output losses. The economic cost of losses of industrial production is not estimated in this analysis. Further, industrial production losses also impair the U.S. wartime preparedness position and ability to sustain wartime needs, imposing significant national security costs as well. Therefore, in terms of both economic and national security preparedness, the costs of a cobalt supply disruption considered in this analysis are only the lower boundary of their actual value.

The second limitation is that the effects of material processing flows and required time paths for adjustments are also not included in the cobalt supply disruption impacts included in the analysis, and could be substantial. The cobalt material processing and trade flows are presented in Exhibit 13. The tail position of the U.S. in the material production-consumption plan flow increases U.S. vulnerability to a cobalt shortage relative to other consumers. Cobalt mined outside of central Africa is typically exported for metal refinement. A small portion, 1-2 percent, of world production is exported for refinement in the U.S. Japan and Europe, however, also major consumers, refine most of the non-Central Africa produced cobalt. If a serious disruption of Central African supply occurred, the U.S. could expect the major consuming countries to meet their own needs before the needs of the import market. Based on current material processing/trade flows, an interruption of Zairean shipments could result in reducing U.S. cobalt supply by 50 percent. The market model estimates the disruption impact on consumption to be only 21 percent because it does not include these potential impacts of material processing flows.

V. CONCLUSIONS AND RECOMMENDATION

CONCLUSIONS

Continuing political instability in central Africa poses a significant threat to two-thirds of the cobalt supplied to the U.S. The direct economic costs of a one year disruption in the supply of Zairean cobalt is conservatively estimated at nearly $4 billion in the absence of a policy for dealing with this possibility. Even the relatively minor cobalt supply problems of recent years resulted in significant (albeit unestimated) economic costs stemming from a doubling of production leadtimes for jet aircraft engines and replacement parts, and a four-fold increase in cobalt prices.

The economic costs of a cobalt supply disruption, coupled with the critical impact such a disruption would have on our defense posture, strongly suggests that a cobalt supply policy be adopted. The analysis reveals that a policy which provides for a mixture of stockpile purchases and government-stimulated domestic production is better than stockpiling alone. Further, the analysis reveals that the policy option known as "Hybrid 3," which provides for annual cobalt purchases of 1.42 million pounds and government-stimulated production of 10 million pounds annually, is superior to the other options considered. This is true whether the country faces normal market conditions or is subject to a supply disruption in the next few years.

Optimal domestic production, vis-a-vis stockpiling, in the proposed floor price range would approximate 13 million pounds per year. Economic constraints, as estimated by the Bureau of Mines, hold feasible domestic production to ten million pounds annually.

RECOMMENDATION

Therefore, it is recommended that the Hybrid 3 policy option be selected for implementation and that the necessary action steps required to implement this option be undertaken as soon as possible.

APPENDIX A

DOMESTIC COBALT PRODUCTION PLANS AND POTENTIAL

This appendix describes the cobalt production plans and potential for:

- Reopening the mine at Blackbird, Idaho
- Reopening the mine at Madison, Missouri
- Developing a mine in the Gasquet Mountains area of California
- Upgrading a refinery in Bruitwait, Louisiana
- Deposits in northeastern Minnesota.

BLACKBIRD, IDAHO

The Blackbird property is a copper/cobalt occurrence located in the Blackbird district of Idaho, near the town of Cobalt, about 40 miles from Salmon, Idaho. Since about 1900, cobalt has been mined intermittently in this district. This district is one of the rare locations where cobalt has been mined as a principal product. Mining and milling activities were at their peak from the 1950's until 1967, when operations ceased.

Noranda Mining Co. purchased from Hanna Mining Co. an option on the property in 1977, and conducted an extensive feasibility study of the re-opening of the Blackbird Mine. The investigations included an extensive diamond drilling program, metallurgical testwork, and environmental and socioeconomic studies. Noranda/Hanna's project location map is illustrated in Exhibit A-1.

The Blackbird deposit lies in a "cobalt belt" occurrence about 20 miles long that stretches from Iron Creek in the southeast to Salmon River in the northwest. The sediments are tightly folded along northwest-trending axis. Primary ore minerals are cobaltite, chalcopyrite, and pyrite in disseminated and lens-like forms, plus minor amounts of gold and bismuth telluride.

Exploration has resulted in defining proven reserves of 5.4 million tons of ore grading of .71 percent cobalt and 1.24 percent copper. Presently, the mill at Blackbird can treat 300 tons of concentrate per day and has been permitted for 1200 tons. Potential annual cobalt production is estimated at four million pounds and could be on stream by 1985. If the pilot plant is successful, and Noranda proceeds with plans, a production rate of 1,200 tons of ore per calendar day will gradually build up over a four year period. Full-scale operations are feasible for the mid 1980's.

The capital investment required for the mining and refining of cobalt are estimated at $220 million for an annual production capabity of four million pounds. The level of cobalt production, whether the domestic refinery investment will be made, are tentative.

MADISON, MISSOURI

The Madison mine is in Madison County in the Fredericktown Area. The cobaltiferrous deposits near Fredericktown are in the southeastern Missouri lead district. Previously this property had been mined to primarily produce lead and copper. However, some nickel-cobalt concentrate was produced in 1941. After the war, lead and copper continued to be produced.

Anschutz Mining Corporation, a privately-owned company principally engaged in the exploration of natural resources, has purchased, or has options to purchase, the Madison mine and surrounding mine properties. The Anschutz project location map is illustrated in Exhibit A-2.

EXHIBIT A-1

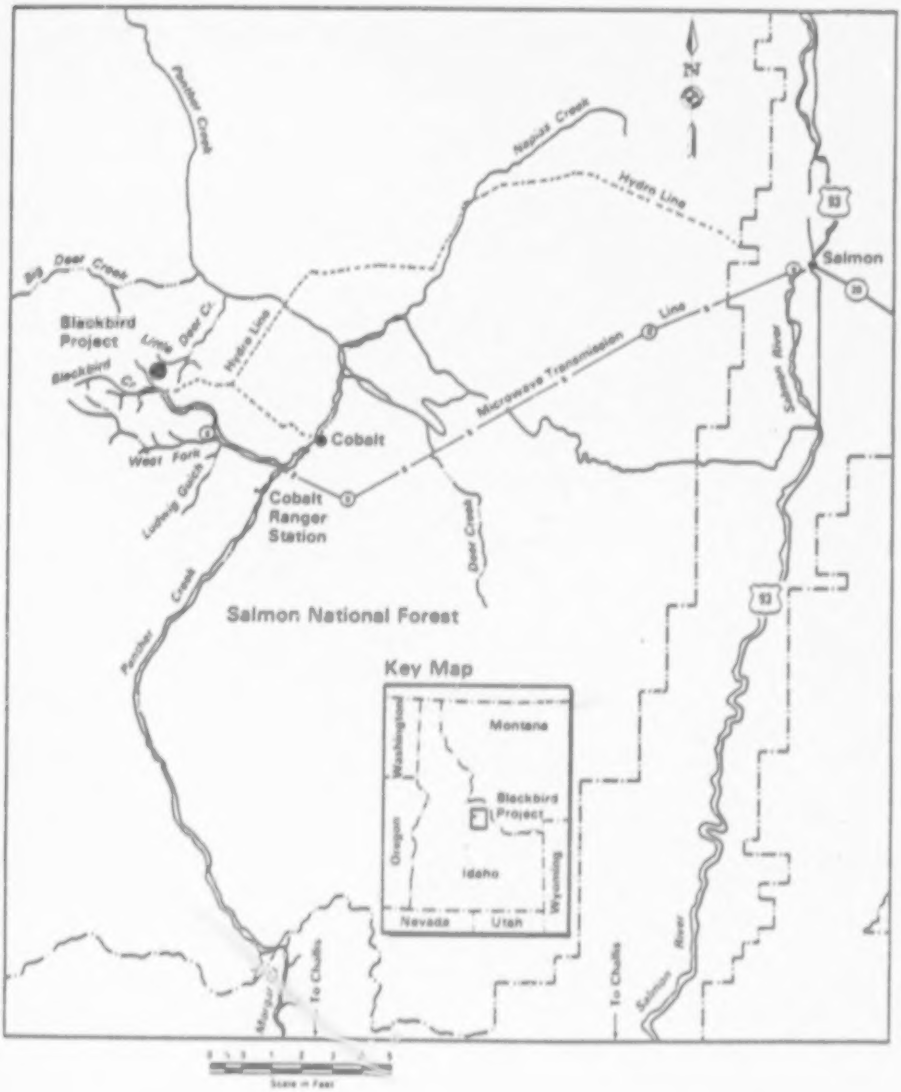
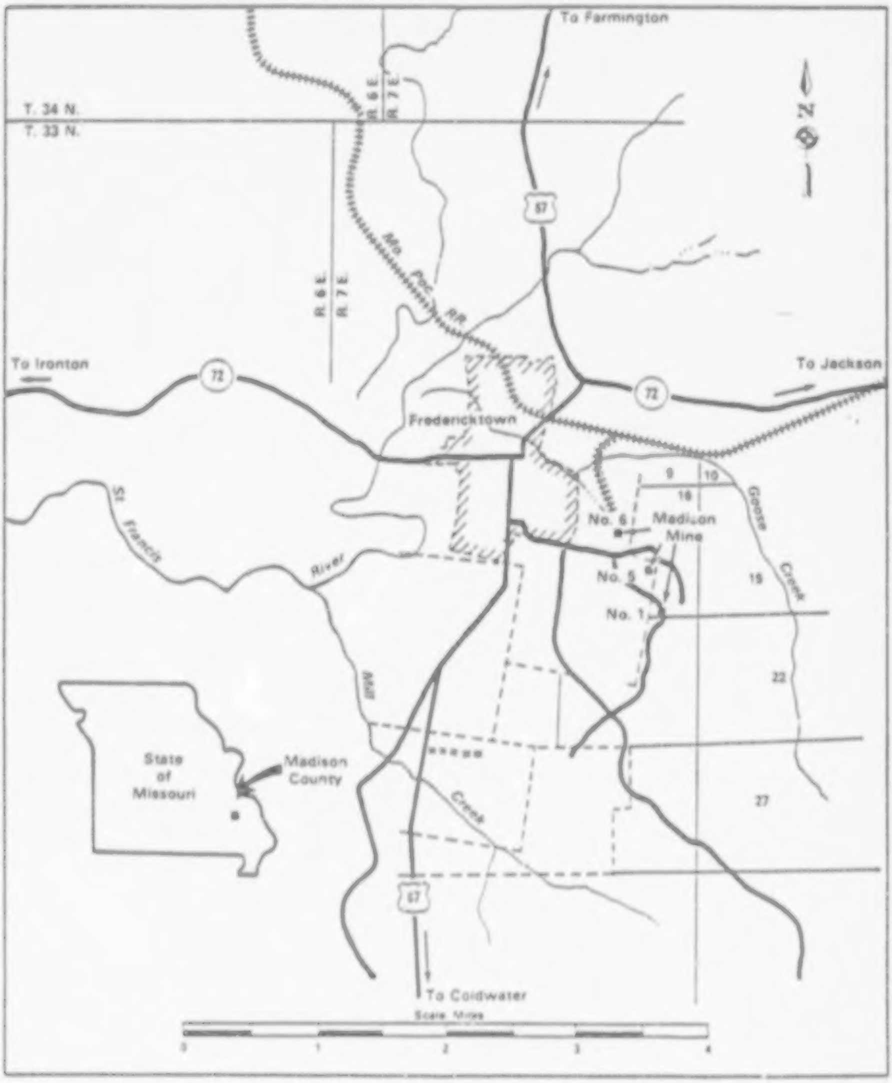

N
Panther Creek
Napias Creek
Hydro Line
Salmon
93
28
Big Deer Creek
Blackbird Project
Little Deer Cr.
Hydro Line
Blackbird Cr.
Microwave Transmission Line
Salmon River
West Fork
Cobalt
Ludwig Gulch
Cobalt Ranger Station
Deer Creek
Panther Creek
Salmon National Forest
Key Map
Washington
Montana
Blackbird Project
Oregon
Idaho
Wyoming
Nevada
Utah
Morgan Cr.
To Challis
To Challis
Salmon River
Scale in Feet

EXHIBIT A-2

Location Map of Madison Mine, Madison County, Mo.


To Farmington
N
T. 34 N.
T. 33 N.
R 6E
R 7E
67
Mo. Pac. RR
R 6E
R 7E
To Ironton
72
Fredericktown
72
To Jackson
St. Francis River
9
10
16
No. 6
Madison Mine
Goose Creek
No. 5
15
No. 1
22
Mill Creek
State of Missouri
Madison County
27
67
To Coldwater
Scale Miles
0
1
2
3
4

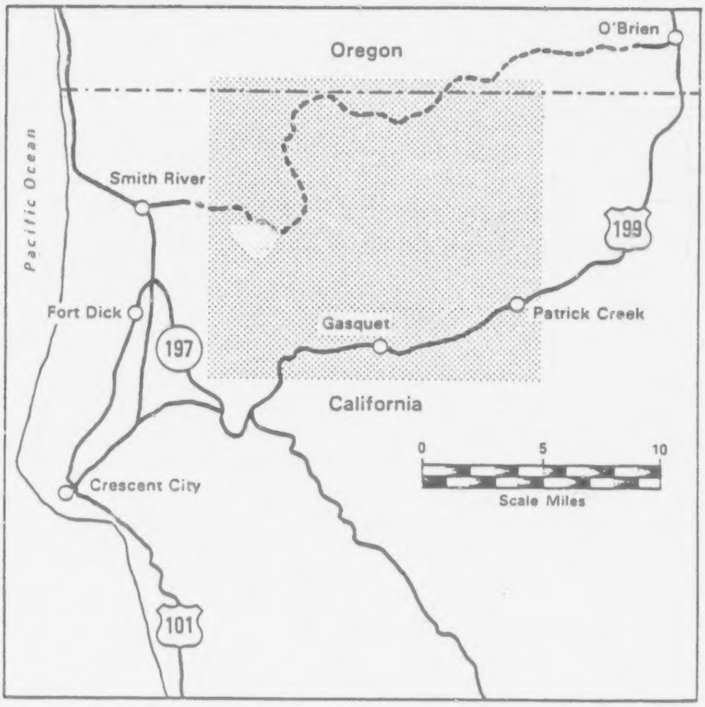
The Ralph M. Parsons Company performed a feasibility study for Anschutz that evaluated ore reserves, mining methods and costs, metallurgical methods and capital costs of the cobalt project the Anschutz company is considering.

Proven ore reserves are 8.7 million tons of ore containing cobalt grading of .24 percent, .34 percent nickel, .45 percent copper and .65 percent lead. In addition to the ore, there are 2.5 million tons of tailings containing .1 percent cobalt. Potential annual cobalt production is estimated at two million pounds and could begin in 1984. The investment costs for mining and refining the ore into high purity cobalt metal are $150 million. Exploration and drilling are continuing, however, market conditions and risk of predatory pricing, reportedly, have resulted in a decision to not proceed with production plans.

GASQUET MOUNTAINS AREA OF CALIFORNIA

Lateritic ores, containing nickel, cobalt and chromium, are plentiful in Northern California and Southern Oregon. California Nickel Company is developing a nickel-chromium-cobalt mine at the Gasquet Mountains near Crescent City, California as illustrated in Exhibit A-3. Economic and environmental feasibility studies have been prepared. Geological investigations and drilling indicate the lateritic ores of the Gasquet project contain about 35,000 tons of cobalt, 730,000 tons of chrome and 320,000 tons of nickel. Ore grades average .102 percent cobalt, two percent chromium and .872 percent nickel. Recovery rates are estimated at 80, 50 and 90 percent for cobalt, chromium and nickel respectively. Production is planned to begin in 1984. Potential annual production of cobalt, chrome and nickel are 2.6, 27 and 140 million pounds respectively.

EXHIBIT A-3


Oregon
O'Brien
Pacific Ocean
Smith River
199
Fort Dick
197
Gasquet
Patrick Creek
California
0
5
10
Scale Miles
Crescent City
101

BRITWAIT, LOUISIANA

The only domestic cobalt refinery is in Louisiana. Cobalt is extracted from an imported nickel-copper-cobalt matte by the AMAX company. The cobalt produced is not in the high purity metal form. Potential exists to (1) upgrade the current metal produced to a high purity metal, suitable for the most stringent applications, (2) recover an additional one million pounds of cobalt per annum currently lost in their lead-zinc production, and (3) recover cobalt from other cobalt bearing feedstocks. The project would require additional developmental activities and the installation of an electrowinning and a solvent extraction facility.

DULUTH, MINNESOTA

The Minnesota State Planning Agency recently released results of a study which describes mineral deposits in Northeastern Minnesota, estimated to contain 4.4 billion tons of ore containing 80-90,000 tons of recoverable cobalt plus large reserves of copper and nickel. Potential annual cobalt recovery is estimated to be 1-2 million pounds. The study is now before the Minnesota Environmental Quality Board for review prior to lifting the state's moratorium on filing mining permits. However, the conversation-sensitivity of this area suggests actual production would not occur before 1990.

Appendix B

No Policy

Nondisruption

Year	Cnsmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	14.01	21.81	0.00	0.00	0.00
1982	16.49	14.14	0.00	0.00	0.00
1983	18.93	13.32	0.00	0.00	0.00
1984	20.90	16.44	0.00	0.00	0.00
1985	22.32	21.83	0.00	0.00	0.00
1986	22.50	22.50	0.00	0.00	0.00
1987	23.06	23.19	0.00	0.00	0.00
1988	24.67	26.55	0.00	0.00	0.00
1989	25.59	28.78	0.00	0.00	0.00
1990	25.97	28.68	0.00	0.00	0.00
Total			0.00	0.00	0.00

Disruption

Year	Cnmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	14.01	21.81	0.00	0.00	0.00
1982	16.49	14.14	0.00	0.00	0.00
1983	18.93	13.32	0.00	0.00	0.00
1984	20.90	16.44	0.00	0.00	0.00
1985	17.53	251.60	0.00	0.00	0.00
1986	13.44	99.63	0.00	0.00	0.00
1987	12.83	6.82	0.00	0.00	0.00
1988	16.72	6.43	0.00	0.00	0.00
1989	26.13	7.19	0.00	0.00	0.00
1990	34.04	11.40	0.00	0.00	0.00
Total			0.00	0.00	0.00

No Policy

Economic Costs — Change from No Policy, No Disruption
Million Constant (81$); 10% DPV

Nondisruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST Low	US Resourc CST High	Foreign Transfers	Gross Costs Low	Gross Costs High	Net Benefit Low	Net Benefit High	Cumulative Low	Cumulative High
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

Disruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST Low	US Resourc CST High	Foreign Transfers	Gross Costs Low	Gross Costs High	Net Benefit Low	Net Benefit High	Cumulative Low	Cumulative High
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	-3126.99	2679.70	-447.29	0.00	0.00	2679.70	2679.70	2679.70	-3126.99	-3126.99	-3126.99	-3126.99
1986	-860.60	517.05	-343.54	0.00	0.00	517.06	517.06	517.06	-860.60	-860.60	-3987.58	-3987.58
1987	-165.80	-252.44	-418.24	0.00	0.00	-252.44	-252.44	-252.44	-165.80	-165.80	-4153.38	-4153.38
1988	-213.73	-281.00	-494.74	0.00	0.00	-281.00	-281.00	-281.00	-213.73	-213.73	-4367.11	-4367.11
1989	260.43	-255.90	4.53	0.00	0.00	-255.90	-255.90	-255.90	250.43	260.43	-4106.68	-4106.68
1990	219.79	-151.21	68.58	0.00	0.00	-151.21	-151.21	-151.21	219.79	219.79	-3886.89	-3886.89
Total	-3886.89	2256.20	-1630.69	0.00	0.00	2256.20	2256.20	2256.20	-3886.89	-3886.89		

No Policy
Budget Estimates — Million Constant (81) $

Nondisruption

Year	Cobalt Price	Acqstn Cost	Subsidy		Total	
			Low	High	Low	High
1981	21.81	0.00	0.00	0.00	0.00	0.00
1982	14.14	0.00	0.00	0.00	0.00	0.00
1983	13.32	0.00	0.00	0.00	0.00	0.00
1984	16.44	0.00	0.00	0.00	0.00	0.00
1985	21.83	0.00	0.00	0.00	0.00	0.00
1986	22.60	0.00	0.00	0.00	0.00	0.00
1987	23.19	0.00	0.00	0.00	0.00	0.00
1988	26.56	0.00	0.00	0.00	0.00	0.00
1989	28.78	0.00	0.00	0.00	0.00	0.00
1990	28.68	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00

Average Total Cost = 0

Disruption

Year	Cobalt Price	Acqstn Cost	Subsidy		Total	
			Low	High	Low	High
1981	21.81	0.00	0.00	0.00	0.00	0.00
1982	14.14	0.00	0.00	0.00	0.00	0.00
1983	13.32	0.00	0.00	0.00	0.00	0.00
1984	16.44	0.00	0.00	0.00	0.00	0.00
1985	251.60	0.00	0.00	0.00	0.00	0.00
1986	99.63	0.00	0.00	0.00	0.00	0.00
1987	6.82	0.00	0.00	0.00	0.00	0.00
1988	6.43	0.00	0.00	0.00	0.00	0.00
1989	7.19	0.00	0.00	0.00	0.00	0.00
1990	11.40	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00

Average Total Cost = 0

Stockpile Only

Nondisruption

Year	Cnsmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	13.99	22.70	4.46	0.00	0.00
1982	16.38	15.86	4.46	0.00	0.00
1983	18.55	15.88	4.46	0.00	0.00
1984	20.10	21.78	4.46	0.00	0.00
1965	21.10	28.49	4.46	0.00	0.00
1986	21.90	25.38	4.46	0.00	0.00
1987	21.00	23.11	4.46	0.00	0.00
1988	21.90	27.34	4.46	0.00	0.00
1989	24.10	34.36	4.46	0.00	0.00
1990	25.20	36.67	4.46	0.00	0.00
Total			44.60	0.00	0.00

Disruption

Year	Cnsmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	13.99	22.70	4.46	0.00	0.00
1982	16.38	15.86	4.46	0.00	0.00
1983	18.56	15.88	4.46	0.00	0.00
1984	20.10	21.78	4.46	0.00	0.00
1985	16.84	258.08	-5.02	0.00	0.00
1986	13.14	88.83	0.00	0.00	0.00
1987	12.79	6.77	4.46	0.00	0.00
1988	16.90	6.46	4.46	0.00	0.00
1989	26.67	7.70	4.46	0.00	0.00
1990	33.34	17.47	4.46	0.00	0.00
Total			30.66	0.00	0.00

Stockpile Only

Economic Costs — Change from No Policy, No Disruption
Million Constant (81$); 10% DPV

Nondisruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST		Foreign Transfers	Gross Costs		Net Benefit		Cumulative	
				Low	High		Low	High	Low	High	Low	High
1981	-12.50	12.06	-0.45	0.00	0.00	113.31	113.31	113.31	-113.75	-113.75	-113.75	-113.75
1982	[illegible]	[illegible]	-1.50	0.00	0.00	88.22	88.22	88.22	-89.72	-89.72	-203.48	-203.48
1983	[illegible]	[illegible]	-4.58	0.00	0.00	93.65	93.65	93.65	-98.24	-98.24	-301.71	-301.71
1984	-82.36	70.88	-11.49	0.00	0.00	143.87	143.87	143.87	-155.36	-155.36	-457.08	-457.08
1985	[illegible]	[illegible]	-20.97	0.00	0.00	164.55	164.55	164.55	-185.52	-185.52	-642.59	-642.59
1986	[illegible]	[illegible]	-8.92	0.00	0.00	101.02	101.02	101.02	-109.94	-109.94	-752.54	-752.54
1987	[illegible]	[illegible]	28.94	0.00	0.00	30.25	30.25	30.25	-59.18	-59.18	-811.72	-811.72
1988	[illegible]	[illegible]	-38.30	0.00	0.00	33.70	33.70	33.70	-72.00	-72.00	-883.72	-883.72
1989	-64.67	[illegible]	-21.94	0.00	0.00	114.21	114.21	114.21	-136.16	-136.16	-1019.88	-1019.88
1990	-86.72	76.05	-10.67	0.00	0.00	145.41	145.41	145.41	-156.08	-156.08	-1175.96	-1175.96
Total	-460.26	312.51	-147.75	0.00	0.00	1028.20	1028.20	1028.20	-1175.96	-1175.96		

Disruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST		Foreign Transfers	Gross Costs		Net Benefit		Cumulative	
				Low	High		Low	High	Low	High	Low	High
1981	-12.50	12.06	-0.45	0.00	0.00	113.31	113.31	113.31	-113.75	-113.75	-113.75	-113.75
1982	-25.48	23.98	-1.50	0.00	0.00	88.22	88.22	88.22	-89.72	-89.72	-203.48	-203.48
1983	-39.70	35.12	-4.58	0.00	0.00	93.65	93.65	93.66	-98.24	-98.24	-301.71	-301.71
1984	-82.36	70.88	-11.49	0.00	0.00	143.87	143.87	143.87	-155.36	-155.36	-457.08	-457.08
1985	-3132.42	2612.36	-520.06	0.00	0.00	1734.40	1734.40	1734.40	-2254.46	-2254.46	-2711.54	-2711.54
1986	-733.92	410.38	-323.54	0.00	0.00	410.38	410.38	410.38	-733.92	-733.92	-3445.45	-3445.45
1987	-166.08	-252.93	-419.01	0.00	0.00	-235.87	-235.87	-235.87	-183.14	-183.14	-3628.59	-3628.59
1988	-214.29	-280.11	-494.40	0.00	0.00	-265.32	-265.32	-265.32	-229.08	-229.08	-3857.67	-3857.67
1989	256.93	-247.74	9.19	0.00	0.00	-231.71	-231.71	-231.71	240.90	240.90	-3616.77	-3616.77
1990	140.93	-68.81	72.12	0.00	0.00	-36.77	-36.77	-35.77	107.89	107.89	-3508.88	-3508.88
Total	-4008.90	2316.18	-1693.72	0.00	0.00	1815.17	1815.17	1815.17	-3508.88	-3508.88		

Stockpile Only
Budget Estimates — Million Constant (81) $

Nondisruption

Year	Cobalt Price	Acqstn Cost	Subsidy Low	Subsidy High	Total Low	Total High
1981	22.70	101.25	0.00	0.00	101.25	101.25
1982	15.85	70.67	0.00	0.00	70.67	70.67
1983	15.88	70.83	0.00	0.00	70.83	70.83
1984	21.78	97.16	0.00	0.00	97.16	97.16
1985	28.49	127.06	0.00	0.00	127.06	127.06
1986	25.38	113.20	0.00	0.00	113.20	113.20
1987	23.11	103.06	0.00	0.00	103.06	103.06
1988	27.34	121.94	0.00	0.00	121.94	121.94
1989	34.36	153.24	0.00	0.00	153.24	153.24
1990	36.67	163.54	0.00	0.00	163.54	163.54
Total		1121.95	0.00	0.00	1121.95	1121.95

Average Total Cost = 1121.95

Disruption

Year	Cobalt Price	Acqstn Cost	Subsidy Low	Subsidy High	Total Low	Total High
1981	22.70	101.25	0.00	0.00	101.25	101.25
1982	15.85	70.67	0.00	0.00	70.67	70.67
1983	15.88	70.83	0.00	0.00	70.83	70.83
1984	21.78	97.16	0.00	0.00	97.16	97.16
1985	256.06	-1285.41	0.00	0.00	-1285.41	-1285.41
1986	88.93	0.00	0.00	0.00	0.00	0.00
1987	6.77	30.21	0.00	0.00	30.21	30.21
1988	6.46	28.82	0.00	0.00	28.82	28.82
1989	7.70	34.35	0.00	0.00	34.35	34.35
1990	17.47	77.91	0.00	0.00	77.91	77.91
Total		-774.21	0.00	0.00	-774.21	-774.21

Average Total Cost = -774.21

Hybrid #1

Nondisruption

Year	Cnsmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	14.00	22.36	2.92	0.00	0.00
1982	16.42	15.18	2.92	0.00	0.00
1983	18.69	14.99	2.92	0.00	0.00
1984	20.47	17.86	2.92	5.00	5.00
1985	21.96	20.00	2.92	5.00	5.00
1986	22.61	18.63	2.92	5.00	5.00
1987	23.74	19.44	2.92	5.00	5.00
1988	25.60	25.21	2.92	5.00	5.00
1989	26.23	30.02	2.92	5.00	5.00
1990	26.13	28.94	2.92	5.00	5.00
Total			29.20	35.00	35.00

Disruption

Year	Cnsmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	14.00	22.27	2.92	0.00	0.00
1982	16.42	15.18	2.92	0.00	0.00
1983	18.69	14.99	2.92	0.00	0.00
1984	20.47	17.86	2.92	5.00	5.00
1985	18.83	141.24	-5.02	5.00	5.00
1986	15.54	65.12	0.00	5.00	5.00
1987	16.61	7.76	2.92	5.00	5.00
1988	19.38	7.36	2.92	5.00	5.00
1989	27.75	9.01	2.92	5.00	5.00
1990	32.40	20.73	2.92	5.00	5.00
Total			18.34	35.00	35.00

Hybrid #1

Economic Costs — Change from No Policy, No Disruption
Million Constant (81$); 10% DPV

Nondisruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST		Foreign Transfers	Gross Costs		Net Benefit		Cumulative	
				Low	High		Low	High	Low	High	Low	High
1981	-7.64	7.41	-0.22	0.00	0.00	72.69	72.69	-72.69	-72.91	-72.91	-72.91	-72.91
1982	-15.62	14.68	-0.93	0.00	0.00	54.99	54.99	54.99	-55.92	-55.92	-128.83	-128.83
1983	-25.97	23.16	-2.81	0.00	0.00	59.33	59.33	59.33	-62.13	-62.13	-190.97	-190.97
1984	-22.17	16.63	-5.54	56.35	82.64	-11.28	45.06	71.36	-76.90	-50.61	-267.87	-241.67
1985	-27.71	-32.99	-60.70	51.23	76.13	-61.41	-10.18	13.73	-74.43	-50.52	-342.30	-292.10
1986	54.26	-52.86	1.40	46.57	68.30	-76.92	-30.35	-8.61	10.02	31.76	-332.28	-260.34
1987	49.49	-41.31	8.18	42.34	62.09	-64.14	-21.80	-2.04	10.22	29.98	-322.06	-230.36
1988	17.36	-5.01	12.35	38.49	56.45	-31.91	6.58	24.54	-12.19	5.77	-334.24	-224.59
1989	15.00	23.78	38.78	34.99	51.32	-5.35	29.64	45.97	-7.18	9.14	-341.42	-215.44
1990	2.95	4.90	7.85	31.81	46.65	-20.63	11.18	26.02	-18.17	-3.33	-359.60	-218.77
Total	39.95	-41.59	-1.64	301.78	442.58	-84.62	217.14	357.96	-359.60	-218.77		

Disruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST		Foreign Transfers	Gross Costs		Net Benefit		Cumulative	
				Low	High		Low	High	Low	High	Low	High
1981	-6.50	6.28	-0.22	0.00	0.00	71.31	71.31	71.31	-71.53	-71.53	-71.53	-71.53
1982	-15.62	14.68	-0.93	0.00	0.00	54.99	54.99	54.99	-55.92	-55.92	-127.46	-127.46
1983	-25.97	23.16	-2.81	0.00	0.00	59.33	59.33	59.33	-62.13	-62.13	-189.59	-189.59
1984	-22.17	16.63	-5.54	56.35	82.64	-11.28	45.06	71.36	-76.90	-50.61	-266.49	-240.20
1985	-1678.07	1483.71	-194.36	51.23	75.13	517.09	568.31	592.22	-796.58	-762.67	-1063.07	-1002.87
1986	-503.32	313.98	-189.34	46.57	68.30	111.80	158.37	180.10	-359.44	-347.71	-1422.51	-1360.58
1987	-168.38	-233.46	-401.84	42.34	62.09	-242.57	-200.23	-180.48	-221.36	-201.61	-1643.88	-1562.19
1988	-216.99	-263.00	-479.99	38.49	56.45	-270.86	-232.37	-214.41	-265.58	-247.62	-1909.46	-1799.81
1989	245.93	-226.89	19.04	34.99	51.32	-235.63	-200.65	-184.32	203.36	219.69	-1706.10	-1580.12
1990	98.35	-30.99	67.36	31.81	46.65	-48.27	-17.47	-2.62	69.98	84.83	-1636.11	-1495.29
Total	-2292.74	1104.11	-1188.63	301.78	442.58	4.90	306.06	447.48	-1636.11	-1495.29		

Hybrid #2

Nondisruption

Year	Cnsmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	14.00	22.26	2.36	0.00	0.00
1982	16.43	14.96	2.36	0.00	0.00
1983	18.73	14.62	2.36	0.00	0.00
1984	20.58	16.81	2.36	7.00	5.00
1985	22.32	17.69	2.36	7.00	5.00
1986	23.17	16.46	2.36	7.00	5.00
1987	24.42	17.43	2.36	7.00	5.00
1988	26.30	22.82	2.36	7.00	5.00
1989	26.85	27.71	2.36	7.00	5.00
1990	26.72	29.66	2.36	7.00	5.00
Total			23.60	49.00	35.00

Disruption

Year	Cnmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	14.00	22.25	2.36	0.00	0.00
1982	16.43	14.96	2.36	0.00	0.00
1983	18.73	14.62	2.36	0.00	0.00
1984	20.58	16.81	2.36	7.00	5.00
1985	19.58	107.08	-5.02	7.00	5.00
1986	16.67	56.23	0.00	7.00	5.00
1987	16.76	8.28	2.36	7.00	5.00
1988	20.75	7.88	2.36	7.00	5.00
1989	28.20	9.87	2.36	7.00	5.00
1990	32.01	21.30	2.36	7.00	5.00
Total			13.86	49.00	35.00

Hybrid #2

Economic Costs — Change from No Policy, No Disruption
Million Constant (81$); 10% DPV

Nondisruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST		Foreign Transfers	Gross Costs		Net Benefit		Cumulative	
				Low	High		Low	High	Low	High	Low	High
1981	-6.17	5.95	-0.22	0.00	0.00	58.46	58.46	58.46	-58.68	-58.68	-58.68	-58.68
1982	-12.32	11.53	-0.79	0.00	0.00	43.63	43.63	43.63	-44.43	-44.43	-103.11	-103.11
1983	-20.22	17.91	-2.31	0.00	0.00	46.42	46.42	46.42	-48.73	-48.73	-151.83	-151.83
1984	-5.78	1.78	-4.00	78.89	115.70	-56.81	22.08	58.89	-62.89	-26.08	-214.73	-177.91
1985	63.13	-63.13	0.00	71.72	105.18	-119.19	-47.48	-14.01	14.01	47.48	-200.71	-130.43
1986	85.69	-77.59	8.10	65.20	95.62	-125.01	-59.81	-29.39	37.49	67.92	-163.22	-62.52
1987	77.10	-61.51	15.59	59.27	86.93	-107.17	-47.90	-20.24	35.84	63.50	-127.38	0.98
1988	48.85	-28.20	20.65	53.88	79.03	-82.53	-28.65	-3.50	24.16	49.30	-103.23	50.28
1989	13.05	3.56	16.60	48.98	71.84	-56.44	-7.46	15.41	1.20	24.06	-102.04	74.33
1990	11.02	20.29	31.31	44.53	65.31	-38.07	6.46	27.24	4.07	24.85	-97.98	99.19
Total	254.34	-169.40	84.94	422.47	619.62	-436.71	-14.25	182.90	-97.98	99.19		

Disruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST		Foreign Transfers	Gross Costs		Net Benefit		Cumulative	
				Low	High		Low	High	Low	High	Low	High
1981	-6.17	5.95	-0.22	0.00	0.00	58.46	58.46	58.46	-58.68	-58.68	-58.68	-58.68
1982	-12.32	11.53	-0.79	0.00	0.00	43.63	43.63	43.63	-44.43	-44.43	-103.11	-103.11
1983	-20.22	17.91	-2.31	0.00	0.00	46.42	46.42	46.42	-48.73	-48.73	-151.83	-151.83
1984	-5.78	1.78	-4.00	78.89	115.70	-56.81	22.08	58.89	-62.89	-26.08	-214.73	-177.91
1985	-1219.50	1098.90	-120.60	71.72	105.18	219.98	291.70	325.17	-445.77	-412.30	-660.49	-590.21
1986	-397.94	257.25	-140.69	65.20	95.62	17.21	82.40	112.83	-253.52	-223.10	-914.02	-813.31
1987	-167.52	-223.48	-391.01	59.27	86.93	-245.17	-185.90	-158.25	-232.76	-205.10	-1146.78	-1018.41
1988	-217.65	-252.27	-469.92	53.88	79.03	-271.03	-217.16	-192.00	-277.92	-252.77	-1424.69	-1271.18
1989	237.23	-213.70	23.53	48.98	71.84	-235.07	-186.09	-163.23	186.76	209.62	-1237.94	-1061.57
1990	90.70	-26.70	64.00	44.53	65.31	-68.61	-24.08	-3.30	67.30	88.08	-1170.63	-973.48
Total	-1719.17	677.17	-1042.01	422.47	619.62	-490.99	-68.53	128.62	-1170.63	-973.48		

Hybrid #1
Budget Estimates — Million Constant (81) $

Nondisruption

Year	Cobalt Price	Acqstn Cost	Subsidy		Total	
			Low	High	Low	High
1981	22.35	65.27	0.00	0.00	65.27	65.27
1982	15.18	44.34	0.00	0.00	44.34	44.34
1983	14.89	43.76	0.00	3.00	43.76	43.76
1984	17.86	52.16	0.00	7.38	52.16	59.73
1985	20.80	58.40	0.00	3.11	58.40	61.98
1986	18.63	54.40	0.00	5.94	54.40	60.37
1987	13.44	58.77	0.07	4.22	58.77	62.02
1988	25.21	73.60	0.00	0.00	73.60	74.60
1989	30.02	87.66	0.00	0.00	87.66	87.66
1990	28.94	84.51	0.00	0.00	84.51	84.51
Total		620.87	0.00	20.56	620.87	645.04

Average Total Cost = 632.959

Disruption

Year	Cobalt Price	Acqstn Cost	Subsidy		Total	
			Low	High	Low	High
1981	22.27	65.03	0.00	0.00	65.03	65.03
1982	15.18	44.34	0.00	0.00	44.34	44.34
1983	14.90	43.76	0.00	0.00	43.76	43.76
1984	17.86	52.16	0.00	7.38	52.16	59.73
1985	141.24	-709.03	0.00	0.00	-709.03	-708.64
1986	65.12	0.00	0.00	0.00	0.00	0.41
1987	7.78	22.66	25.85	58.03	48.51	80.95
1988	7.35	21.47	27.88	58.06	49.35	85.66
1989	9.01	26.32	0.00	0.00	26.32	26.32
1990	20.73	60.53	0.00	0.00	60.53	60.53
Total		-372.76	53.74	121.46	-319.02	-241.90

Average Total Cost = -280.46

Hybrid #2
Budget Estimates — Million Constant (81) $

Nondisruption

Year	Cobalt Price	Acqstn Cost	Subsidy Low	Subsidy High	Total Low	Total High
1981	22.25	52.61	0.00	0.00	52.61	52.61
1982	14.96	35.32	0.00	0.00	35.32	35.32
1983	14.62	34.49	0.00	0.00	34.49	34.49
1984	16.81	39.87	0.00	10.79	39.87	50.75
1985	17.69	41.75	0.00	7.72	41.75	50.20
1986	16.48	38.85	0.00	12.53	38.85	52.79
1987	17.43	41.16	0.00	8.23	41.16	51.44
1988	22.82	53.85	0.00	0.00	53.85	56.24
1989	27.71	65.40	0.00	0.00	65.40	65.40
1990	29.66	70.00	0.00	0.00	70.00	70.00
Total		472.98	0.00	39.27	472.98	519.22

Average Total Cost = 496.098

Disruption

Year	Cobalt Price	Acqstn Cost	Subsidy Low	Subsidy High	Total Low	Total High
1981	22.25	52.61	0.00	0.00	52.61	52.61
1982	14.96	35.32	0.00	0.00	35.32	35.32
1983	14.62	34.49	0.00	0.00	34.49	34.49
1984	16.81	39.87	0.00	10.79	39.87	50.75
1985	107.06	-537.42	0.00	0.00	-537.42	-536.81
1986	56.23	0.00	0.00	0.00	0.00	0.65
1987	8.28	19.55	23.24	53.42	42.79	75.38
1988	7.08	18.59	25.27	55.46	43.86	80.16
1989	9.87	23.30	0.00	0.00	23.30	23.30
1990	21.30	50.28	0.00	0.00	50.28	50.28
Total		-263.75	48.52	119.65	-215.23	-134.00

Average Total Cost = -174.615

Hybrid #3

Nondisruption

Year	Cnsmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	14.01	21.83	1.42	0.00	0.00
1982	16.46	14.19	1.42	0.00	0.00
1983	18.92	13.39	1.42	0.00	0.00
1984	20.96	14.60	1.42	10.00	10.00
1985	22.09	14.92	1.42	10.00	10.00
1986	23.97	13.78	1.42	10.00	10.00
1987	26.40	14.61	1.42	10.00	10.00
1988	27.46	18.64	1.42	10.00	10.00
1989	28.07	23.21	1.42	10.00	10.00
1990	27.89	24.17	1.42	10.00	10.00
Total			14.20	70.00	70.00

Disruption

Year	Cnmptn Mil lbs	Price $/lb	GSA Prchse	U. S. Prdctn	USG Gurnted
1981	14.01	21.83	1.42	0.00	0.00
1982	16.46	14.19	1.42	0.00	0.00
1983	18.92	13.39	1.42	0.00	0.00
1984	20.96	14.60	1.42	10.00	10.00
1985	20.89	64.88	-5.02	10.00	10.00
1986	18.73	40.62	0.00	10.00	10.00
1987	19.00	9.15	1.42	10.00	10.00
1988	22.91	8.71	1.42	10.00	10.00
1989	28.93	10.44	1.42	10.00	10.00
1990	31.92	17.20	1.42	10.00	10.00
Total			6.34	70.00	70.00

Hybrid #3

Economic Costs — Change from No Policy, No Disruption
Million Constant (81$); 10% DPV

Nondisruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST Low	US Resourc CST High	Foreign Transfers	Gross Costs Low	Gross Costs High	Net Benefit Low	Net Benefit High	Cumulative Low	Cumulative High
1981	0.33	0.33	0.65	0.00	0.00	31.33	31.33	31.33	-30.68	-30.68	-30.68	-30.68
1982	-0.69	0.16	-0.52	0.00	0.00	18.49	18.49	18.49	-19.01	-19.01	-49.69	-49.69
1983	-1.09	0.98	-0.11	0.00	0.00	16.69	16.69	16.69	-16.80	-16.80	-66.48	-66.48
1984	28.82	-28.12	0.70	112.70	165.29	-122.27	-9.57	43.02	-42.32	10.27	-108.81	-56.21
1985	106.74	-99.59	7.15	102.45	150.26	-187.01	-84.56	-36.75	43.90	91.71	-64.91	35.50
1986	125.85	-109.29	16.56	93.14	136.60	-182.71	-89.57	-46.11	62.67	106.13	-2.24	141.63
1987	118.67	-93.78	24.90	84.67	124.18	-164.06	-79.39	-39.87	64.77	104.29	62.53	245.91
1988	105.80	-73.56	32.24	76.97	112.89	-155.63	-78.66	-42.74	74.98	110.90	137.51	356.81
1989	69.69	-39.62	30.06	69.98	102.63	-132.52	-62.55	-29.89	59.97	92.62	197.48	449.43
1990	51.40	-29.89	21.52	63.61	93.30	-117.85	-54.24	-24.55	46.07	75.76	243.54	525.19
Total	605.52	-472.36	133.16	603.52	885.17	-995.55	-392.02	-110.38	243.54	525.19		

Disruption

Year	Cnsmer Srpls	Cnsmptn Bnft	Gross Bnft	US Resourc CST Low	US Resourc CST High	Foreign Transfers	Gross Costs Low	Gross Costs High	Net Benefit Low	Net Benefit High	Cumulative Low	Cumulative High
1981	0.33	0.33	0.65	0.00	0.00	31.33	31.33	31.33	-30.68	-30.68	-30.68	-30.68
1982	-0.69	0.16	-0.52	0.00	0.00	18.49	18.49	18.49	-19.01	-19.01	-49.69	-49.69
1983	-1.09	0.98	-0.11	0.00	0.00	16.69	16.69	16.69	-16.80	-16.80	-66.48	-66.48
1984	28.82	-28.12	0.70	112.70	165.29	-122.27	-9.57	43.02	-42.32	10.27	-108.81	-56.21
1985	-632.32	590.07	-42.25	102.45	150.26	-73.49	28.97	76.78	-119.03	-71.21	-227.83	-127.43
1986	-231.93	158.04	-73.89	93.14	136.60	-94.19	-1.06	42.41	-116.30	-72.83	-344.13	-200.26
1987	-166.62	-203.68	-370.30	84.67	124.18	-248.01	-163.33	-123.82	-246.48	-206.96	-590.61	-407.22
1988	-217.80	-233.73	-451.53	76.97	112.89	-272.08	-195.11	-159.19	-292.34	-256.42	-882.94	-663.64
1989	233.22	-202.67	30.55	69.98	102.63	-244.46	-174.48	-141.83	172.38	205.04	-710.56	-458.61
1990	140.83	-82.95	57.88	63.61	93.30	-145.54	-81.93	-52.24	110.12	139.81	-600.44	-318.80
Total	-847.26	-1.54	-848.80	603.52	885.17	-1133.53	-530.00	-248.36	-600.44	-318.80		

Hybrid #3
Budget Estimates — Million Constant (81) $

Nondisruption

Year	Cobalt Price	Acqstn Cost	Subsidy		Total	
			Low	High	Low	High
1981	21.83	31.00	0.00	0.00	31.00	31.00
1982	14.19	20.16	0.00	0.00	20.16	20.16
1983	13.39	19.01	0.00	0.00	19.01	19.01
1984	14.60	20.74	0.00	43.61	20.74	66.69
1985	14.92	21.18	0.00	40.48	21.18	66.06
1986	13.78	19.67	0.00	51.86	19.67	78.52
1987	14.51	20.61	0.00	44.54	20.61	75.70
1988	18.64	26.47	0.00	11.64	26.47	61.02
1989	23.21	32.96	0.00	0.00	32.96	32.96
1990	24.17	34.33	0.00	0.00	34.33	34.33
Total		246.01	0.00	192.12	246.01	474.03

Average Total Cost = 360.018

Disruption

Year	Cobalt Price	Acqstn Cost	Subsidy		Total	
			Low	High	Low	High
1981	21.83	31.00	0.00	0.00	31.00	31.00
1982	14.19	20.16	0.00	0.00	20.16	20.16
1983	13.39	19.01	0.00	0.00	19.01	19.01
1984	14.60	20.74	0.00	43.61	20.74	66.69
1985	64.68	-324.70	0.00	0.00	-324.70	-321.94
1986	40.62	0.00	0.00	0.00	0.00	2.94
1987	9.15	13.00	37.79	98.13	50.78	117.44
1988	8.71	12.37	42.19	102.54	54.56	128.16
1989	10.44	14.82	0.00	0.00	14.82	14.82
1990	17.20	24.43	0.00	0.00	24.43	24.43
Total		-169.19	79.98	244.28	-89.2	101.69

Average Total Cost = 6.24295

Appendix C

Direct Economic Cost/Benefit Calculation

Theoretical supply-demand curves are depicted in Exhibit C-2. The intersection of the supply-demand represents that point where the market is in equilibrium, i.e. where supply and demand are equal. Associated with the macro, direct economic net benefits of a mineral supply protection policy are both costs and benefits. Gross direct economic benefits are initially the value of the materials consumed at the market price (area AP_1EQ_1), and the "consumer surplus," the additional value placed on consumption by consumers not reflected in the market price, area P_1EQ_1. Gross benefits are thus the sum of these two, area $ABEQ_1$. Gross direct economic costs to the economy include foreign transfers and the cost of production associated with any domestically produced supply, also termed "the domestic real resource cost." In the absence of domestic production, therefore, gross costs are the value of material sold in the market, area AP_1EQ_1. The net direct economic benefits are gross benefits less gross costs; under normal supply conditions; area P_1BE.

The costs of a mineral disruption are illustrated in Exhibit C-2. In the absence of domestic production, a stockpile release or stockpile purchases; a disruption results in a higher price, P_d and lower cobalt consumption, Q_d. Gross costs increase through foreign transfers. Gross benefits fall through reduced consumption and consumer surplus. The net benefits are, thus, reduced by the area P_1P_dCE.

Cost of a disruption, or in the absence of a disruption, are reduced through supply expansion to the extent: (1) foreign transfers are reduced though lower prices and imports and (2) consumption and consumer surplus are better maintained and these gains exceed the domestic production costs. For illustrative purposes, the net costs of a mineral disruption with domestic production are also presented in Exhibit C-2. Assuming domestic production costs are equal to the pre-disruption market price, net benefits are reduced by the area $P_1P_d'C'E$. Net costs of the supply disruption are thus reduced by $(P_1P_dCE) - (P_1P_dC'E)$.

Exhibit C-1

Net Direct Economic Benefits — Normal Supply

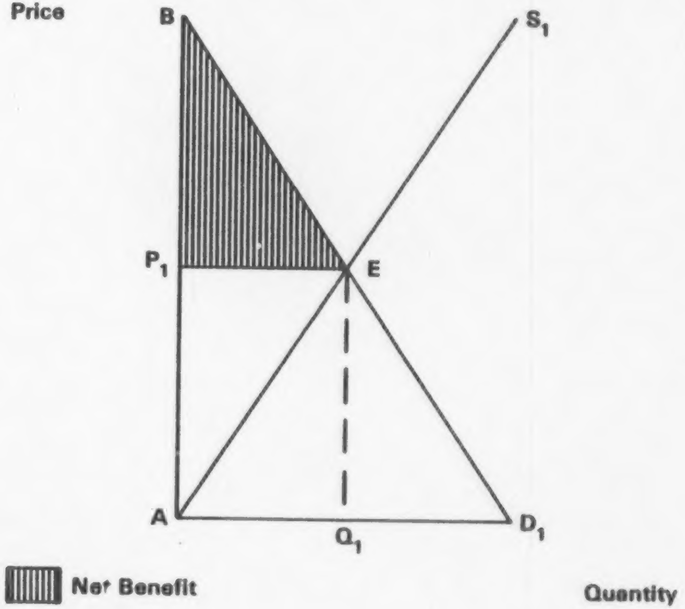
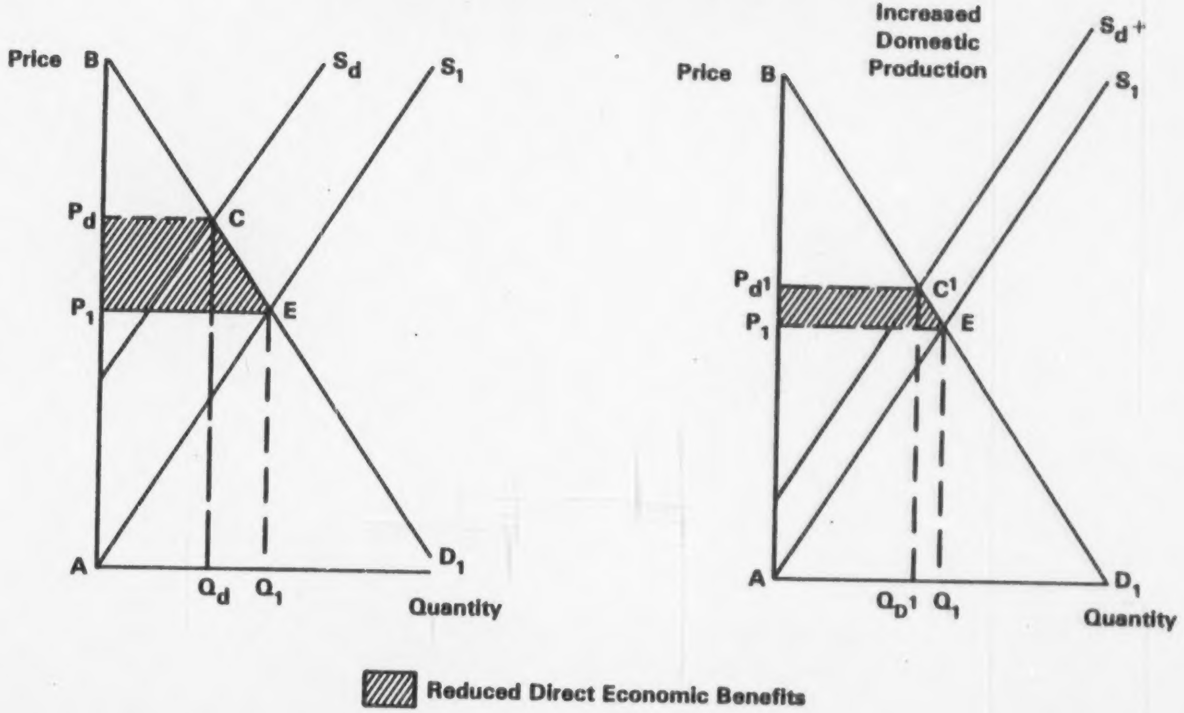


Exhibit C-2
Change in Net Direct Economic Benefits
Foreign Mineral Supply Disruption


Price
B
S_d
S_1
P_d
C
P_1
E
A
D_1
Q_d
Q_1
Quantity
Increased
Domestic
Production
Price
B
S_d +
S_1
$P_d{}^1$
C^1
P_1
E
A
D_1
$Q_D{}^1$
Q_1
Quantity
▨ Reduced Direct Economic Benefits

Senator TRIBLE. Mr. Donnelly.

STATEMENT OF RICHARD DONNELLY, DIRECTOR, INDUSTRIAL RESOURCES, OFFICE OF UNDER SECRETARY FOR RESEARCH AND ENGINEERING, DEPARTMENT OF DEFENSE; ACCOMPANIED BY JOHN ECK

[Complete statement follows:]

STATEMENT BY MR. RICHARD E. DONNELLY, DIRECTOR, INDUSTRIAL RESOURCES, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

Mr. Chairman and members of the Committee, I appreciate this opportunity to appear before you today in connection with your deliberations concerning extension of the Defense Production Act of 1950, as amended.

As the sole statutory vehicle for ensuring that the nation's industrial base is kept in a state of readiness in peacetime with programs that can be expanded in event of national emergency, the Defense Production Act is essential to the national defense. In this regard, the Department of Defense relies particularly on the Defense Production Act to meet its production, deployment and cost containment commitments. The Defense Department requests a straight five-year extension of the current Act to help make sure that these commitments are met.

At this time we are convinced that the industrial base will be capable of responding to increased levels of weapon system acquisition and logistics support and we rely on the continued availability of Title I of the Act to assure timely deliveries of needed industrial resources. The Title I provisions ensure priority treatment of defense programs when necessary to meet scheduled production. In addition, we have requested two hundred million dollars for Title III purchase commitments in fiscal year 1984 to establish or expand domestic production capabilities under those extraordinary circumstances where the free market cannot respond in time to support the national defense, where we are unacceptably dependent upon foreign sources and where this is the best method to meet the need.

The Department of Defense relies primarily on the private, commercial marketplace for production of weapon systems since there is no separate defense industrial establishment. As the economy recovers, competition for industrial resources may increase. Although stronger defense demand will attract new contractors and suppliers to the marketplace, the Congress and Executive branch must also ensure that business dealings with the defense department are as predictable as possible. This includes stabilizing the Defense Production Act authorities to promote confidence in contracting with the government, particularly through sound production commitments, expected market needs, and anticipated costs.

Mr. Chairman, in your invitation to testify you asked our views concerning the consequences that would occur should the Congress fail to extend the Act on a timely basis. A lapse in the Defense Production Act is expected to disrupt planned and established weapon system production schedules, deployment and costs. Ongoing and planned acquisition have delivery schedules based upon expected Congressional funding and expected priority in the marketplace. The funding controls the amount of demand DoD will place upon industry; the industrial priority permits us to keep defense programs on schedule. The worst case scenario would be if a national emergency occurred during an actual lapse since the Title I priorities system would have been dismantled. Since a complete lapse in Defense Production Act authorities has not actually been experienced, we have no historical reference with which to forecast the precise deployment disruptions and budget impacts which would be expected under a postulated future lapse. However, to experience the disruption a lapse in the Defense Production Act would cause is not an acceptable price to pay to acquire this knowledge.

Mr. Chairman you also asked for our views on the appropriateness of using the Defense Production Act as a vehicle for programs relating to skills training, grants to universities, mineral production subsidy programs, and loans and loan guarantees to defense contractors, as is envisioned in legislation introduced in the House of Representatives. Mr. Chairman, you have described H.R. 13, formerly H.R. 5540, which the Administration opposes. H.R. 13 proposes reprogramming $6.75 billion of the defense budget for a national industrial incentives, jobs and training program. We oppose H.R. 13 because it contains duplicative and unnecessary authorities for training and equipment grants which are inappropriate to the purpose of the Defense Production Act. The bill would authorize a multibillion dollar program of government subsidies, price supports, loan guarantees and back-door borrowing authorities that is inconsistent with the Administration's policy of reliance on the market place. Moreover, the funding levels in the bill would also result in substantial addtional federal spending during the coming year. The Department of Defense has fifty million dollars in fiscal year 1983 and two hundred million dollars in fiscal year 1984 for Title III purchase commitments as mentioned earlier. So these additional authorities and funding are not necessary.

We must keep in perspective that the Defense Production Act is the keystone of the structure designed to assure timely production of the weapons and equipment needed to meet the growing Soviet threat. Our commitments to keep production on schedule and within estimated costs were made with the Defense Production authorities intact. In short, removal of the legislature basis upon which these commitments were made is expected to result in stretchouts in our contracts with industry with accompanying cost growth and delays in achieving operational capabilities of the forces. Therefore, I hope you will help us meet our national defense objective by supporting a five-year extension of the Defense Production Act without revision.

This concludes my prepared statement. I will be pleased to answer any additional questions the committee may have.

Senator TRIBLE. Mr. Donnelly, thank you very much and I thank all you gentlemen for your presentations here today.

At the outset I'd like for you to more specifically spell out for the record how this act works. For example, title I provides for the establishment of priorities and allocation of resources. For the sake of the record, gentlemen, give us a specific example of how this authority is used. Everyone has alluded to the authority but no one has spelled out how it works.

PRIORITIES AND ALLOCATION OF RESOURCES

Mr. BRADY. Mr. Chairman, let me begin giving you that answer, and then I'll defer to John Richards. He can give you the answer in very specific terms.

As I have indicated, the DMS, the defense materials system, and the DPS, the defense priority system, work hand-in-hand to implement priorities and allocations under title of Title I.

Basically what happens is that the Department of Defense allots priorities to each contract it awards. If a contractor has difficulty meeting the deadlines within the contract, he comes to Defense and to Commerce and indicates that he's having difficulty. We may assign a priority that requires three things. There is mandatory acceptance, preferential scheduling, and mandatory extension. The subcontracting suppliers also become involved in the same kind of priority allocation.

I'll defer to John to flesh that out.

Mr. RICHARDS. Thank you, Mr. Chairman. We have automated the system somewhat. The Department of Commerce is delegated from the Department of Defense to move its authorities for title I of the Defense Production Act. Those authorities include the assignment of priority ratings on each contract that the Department of Defense places. These are for a product that is eligible for priority treatment under title I. These products or programs have been specifically approved by FEMA.

Upon the assignment of the priority rating, the contractor is required to do three specific things. First, he's required to accept the contract, specifically, the delivery terms of the contract. He's required to extend the priority rating to all subcontracts, vendors and suppliers by identifying the priority rating on the contract purchase orders for materials required to be incorporated into the contract delivered to the Department of Defense, and he's required to give preferential scheduling in his production to the defense contract, but only to the extent necessary to meet the terms of the contract placed by the Department of Defense. In most cases the Department of Defense primes and Defense subs place their orders in sufficient time to have delivery made as required to meet the national security requirements for delivery of weapons systems. If there are production bottlenecks, then the contractors must give preference to the contracts the DOD has identified with priority ratings in production scheduling to assure the delivery to the Department of Defense as required.

Senator TRIBLE. Thank you, sir.

Now I understand that title I also is relevant to the deployment of military forces, to transportation. How does that work?

Mr. KRUEGER. There are a number of resources which can be allocated or assigned priority under title I. These have been delegated by the Director of the Federal Emergency Management Agency to the most appropriate Department. Most of these resources are industrial resources and are the responsibility of the Department of Commerce.

Transportation resources are the responsibility of the Department of Transportation. If the military transportation commands—the airlift command, the sealift command, and the traffic management command—require transportation and have transportation contracts with the civil sector, these are used. In particular, the most dramatic program there is the program called CRAF, the civil reserve air fleet, where the military airlift command in peacetime contracts with major air carriers to have access to their long-range jet planes during a national security emergency. These planes are designed with defense in mind and in some cases the Department of Defense military airlift command pay for special capabilities.

In time of mobilization, the Department of Defense can activate the civil reserve air fleet and it could and would provide a major component of the air assets needed to deploy forces.

There are three stages of CRAF. This is all worked out quite carefully with the military airlift command and the Department of Transportation, Civil Aeronautics Board.

Similar arrangements can work with the rail system and the trucking system. In particular, in the rail system it's important to identify what sort of rolling stock you need to carry outsized cargo such as particular tanks. Without having access to these transportation assets you cannot move, in this case, tanks; in the case of the military airlift command, people, from where they are stationed to where they are needed.

Senator TRIBLE. This would also apply, as I understand it, to the sealift of our forces to the needs of the rapid deployment force, for example?

Mr. KRUEGER. There are a number of authorities there. Some of those are the authorities clearing the Emergency Rate Act and to use the best assets. If we're concerned with NATO, there's a NATO shipping agreement. And finally, some of the authorities in title VII are used with the product tankers to assure availability of product tankers to refuel the rapid deployment force on the high seas.

Senator TRIBLE. Now in title III we have the authorization to support the expansion of our Nation's productive capacity to meet our defense requirements. There's been a lot of discussion about that here today.

Tell me about the machine tool trigger order program which is a part of that program.

MACHINE TOOL ORDER PROGRAM

Mr. KRUEGER. The machine tool trigger order program is a program for which FEMA has oversight responsibility. The purpose of the program is to reduce the amount of time necessary to get needed machine tools into the hands of defense contractors in times of an actual national security emergency when the defense industrial base is expanding or mobilizing.

One of the characteristics of the machine tool industry is that these are custom ordered. So ordinarily it takes a considerable amount of time from the time it's ordered to the time that the machine tool is built. The machine tool industry is very cyclical, and when the economy is booming the order books are full and the lead times are very long. The purpose of the machine tool trigger order program is to break this cycle, to cut down the lead time necessary.

The Department of Defense, working with the defense contractors, and the Department of Commerce has identified what machine tools are typically used by defense contractors and what machine tools would be needed if there is a surge production of key weapon systems. Once that has been identified and the Department of Commerce has identified the manufacturers, the Director of FEMA has sent to some 49 U.S. machine tool manufacturers an invitation to be part of this program. At this point, about 29 contractors have actually signed contracts with GSA to provide these machine tools at the Government's request.

At the time of an actual emergency, GSA with FEMA and DoD guidance, would execute these contracts. Machine tool builders would start making the machine tools in the absence of any order from a commercial firm.

What we are trying to do is put the needed machine tools in the pipeline so when the commercial firm gets the Defense order and needs a machine tool it has already been manufactured for him and he can just take it as it comes off the end of the line.

Senator TRIBLE. Is there any support provided in the interim to maintain the capability to produce these specific machine tools?

Mr. KRUEGER. Not as part of that program. Mr. Donnelly can refer to this. There is a lot of work being done in the machine tool industry using robotics. Robotics are very critical to the manufacture of defense systems, and I think the defense industrial base provides the leading edge in the use of robotics in many areas.

Mr. BRADY. Mr. Chairman, I think you're hitting an issue not only in the machine tool area, but in some other very fundamental areas; namely, smokestack industries in this country that are critical to the defense industrial base.

Last week or the week before last, a section 232 petition was filed by the machine tool industry that alleges that unfair import competition is undermining the machine tool industry from a standpoint of the national security; namely, that there won't be a machine tool industry to respond to the orders Mr. Krueger is talking about. I think that's a very real concern.

The other point that he mentions I'm sure you're familiar with is the proposition before Mr. Brock's office on the subsidization of Japanese machine tools and the effect it's had in this country.

There is no question but that industry is in very, very serious trouble. By the end of this decade, to say nothing about the end of the century, we may not have an industry. Import penetration is increasing at a very rapid rate. The industry here is not making enough money to be able to infuse the capital and the new technology, including robotics, that now is competing against the imports from Japan. So I think your question gets to the heart of what we've only superficially addressed as far as the Defense Production Act is concerned. It's a very, very real problem from the industrial standpoint regarding the industrial base and national security.

Senator **Trible**. It's quite helpful to have a number of agreements in hand at the time of war or national emergency, but if there's no industrial base to support those agreements, then all of our good intentions bring about little result.

I have one additional question and then I'll yield to my colleague. Senator Hecht, I should yield to you now. You have been quite patient.

Senator **Hecht**. Well, thank you, Mr. Chairman.

I'd like to carry on because you asked a question and I didn't get the total answer. Roughly, what are the guidelines in determining the amount of a particular metal that should be stockpiled?

GUIDELINES TO STOCKPILING

Mr. **Krueger**. The Strategic and Critical Material Stockpiling Act says that the stockpile should be sufficient to provide for the military, industrial, and essential civilian needs of the economy during a national security emergency. It further specifies that when talking about national security emergency, we're talking about a situation in which the stockpile is sufficient to provide for not less than 3 years of supplies.

So basically it is a national security emergency of not less than 3 years, and what is needed to supply the military, industrial, and essential civilian requirements of the country.

Senator **Hecht**. Who sets these guidelines?

Mr. **Krueger**. It was set by Congress in 1979 as a part of the statute that controls the stockpile.

Senator **Hecht**. In other words, what individuals are involved?

Mr. **Krueger**. The Federal Emergency Management Agency implements that basic act to determine which material should be in the stockpile and how much of each material. We share an interagency effort that includes eight departments and agencies. They are the Department of Defense, the Department of Commerce, the Department of Interior, the Department of Treasury, the Department of State, Agriculture and Energy, the Office of Management and Budget, the General Services Administration, the National Security Council and Central Intelligence Agency.

Senator HECHT. Roughly how many metals are included in this list?

Mr. KRUEGER. There are 61 materials altogether in the stockpile. If you're talking basic materials, I suspect that at least 45 of those materials are metals and minerals. We can provide a specific answer for the record.

Mr. PEACH. Senator, if I could, I would want to interject a comment.

Senator HECHT. Yes, please.

Mr. PEACH. There's a report that we issued to the Secretary of Interior back on June 3, 1982, dealing with actions to promote a stable supply of strategic and critical minerals and materials and it might be a useful one for you to refer to in general on this subject. We tried to lay out three things which we thought where there did need to be more consideration and study given to as to what materials are put into the stockpile.

In one respect we haven't seen enough attention, we think, looking at just the question of defining what we see as strategic and critical. You can't look at that just solely from an import-dependence kind of situation in deciding what is strategic and critical. You have to look at just how vulnerable you think the United States is with respect to that particular material and the sources of supply that we're dealing with. Then once you go beyond that, you have to look at the question of what is the right kind of federal role; and that's the one question of what we're talking about with cobalt in the example today, as to whether stockpiling is the most sensible approach as opposed to stimulating a domestic industry. And when you can look at that question you've got to look at things like concentration in the way we use material, potential for recycling material, and substitution of other things for cobalt in these areas. And so I think all those are possibilities and I'm not sure even in the case of the cobalt area we have examined as much as we can what the potentials are for recycling and substitution.

Senator HECHT. Mr. Krueger, would it be possible to have a list of these different materials?

Mr. KRUEGER. We would be happy to provide that for the record.

[The following information was subsequently submitted for the record:]

Stockpile Materials

The National Defense Stockpile total inventory is shown in the following table from the Stockpile Report to the Congress October 1981 - March 1982.

The total number of materials is 93 separate forms. Of the 93 forms of materials 37 are metals and 38 are minerals. The 93 forms are grouped into 61 "families", of which 47 families are metals or minerals.

Materials are grouped by "families," and a summary line for each basic family group is included. The materials have been grouped in each family according to their status as raw materials, semifinished products or finished products that contain the same common ingredient. The values shown in the summary line for each family group are expressed in the basic unit common to all members of the group. In all but three cases, this basic unit is the metal equivalent for each form. There is a different conversion factor for each form because each requires different technology and incurs different conversion losses. The factors used for calculating these equivalent amounts and the calculation procedures are in Appendix 2.

Market values are prices at which comparable materials are being traded, or in the absence of trading, values are estimates. They are not necessarily the amount that would be realized if the material were sold.

NATIONAL DEFENSE STOCKPILE INVENTORY OF STRATEGIC AND CRITICAL MATERIALS

March 31, 1982

Commodity	Unit	1980 Goal	Inventory	Value of Inventory (Millions $)	Quantity After Crediting Offset Excess	Quantity After Crediting Offset Deficit
1. Aluminum Metal Group	ST Al Metal	7,150,000	3,444,064	629.8		3,705,936
Alumina	ST	0	0	-		-
Aluminum	ST	700,000	1,733	2.7		698,267
Bauxite, Metal Grade, Jamaica Type	LDT	21,000,000	8,858,881	363.2		12,141,119
Bauxite, Metal Grade, Surinam Type	LDT	6,100,000	5,299,597	263.9		800,403
2. Aluminum Oxide, Abrasive Grain Group	ST Ab Grain	638,000	259,124	128.6		378,876
Aluminum Oxide, Abrasive Grain	ST	0	50,904	63.6	a	
Aluminum Oxide, Fused, Crude	ST	0	249,867	65.0	a	
Bauxite, Abrasive Grade	LCT	1,000,000	0	-		a
3. Antimony	ST	36,000	40,729	162.9	4,729	
4. Asbestos, Amosite	ST	17,000	42,534	27.8	25,534	
5. Asbestos, Chrysotile	ST	3,000	9,958	9.0	6,958	
6. Bauxite, Refractory	LCT	1,400,000	174,599	38.4		1,225,401
7. Beryllium Metal Group	ST Be Metal	1,220	1,061	157.6		159
Beryl Ore (11% BeO)	ST	18,000	17,987	22.8		13
Beryllium Copper Master Alloy	ST	7,900	7,387	73.0		513
Beryllium Metal	ST	400	229	61.8		171
8. Bismuth	LB	2,200,000	2,081,298	5.2		118,702
9. Cadmium	LB	11,700,000	6,328,809	8.9		5,371,191
10. Castor Bean Oil (Sebacic Acid)	LB	22,000,000	12,524,243	9.4		b
11. Chromium, Chemical and Metallurgical Group	ST Cr Metal	1,353,000	1,324,921	1,063.0		28,079
Chromite, Chemical Grade Ore	SDT	675,000	242,414	14.3		c
Chromite, Metallurgical Grade Ore	SDT	3,200,000	2,488,043	260.8		c
Chromium, Ferro, High Carbon	ST	185,000	402,696	294.5	c	
Chromium, Ferro, Low Carbon	ST	75,000	318,892	418.1	c	
Chromium, Ferro, Silicon	ST	90,000	58,355	43.3		c
Chromium, Metal	ST	20,000	3,763	32.0		c
12. Chromite, Refractory Grade Ore	SDT	850,000	391,414	42.6		458,586

Commodity	Unit	1980 Goal	Inventory	Value of Inventory (Millions $)	Quantity After Crediting Offset Excess	Quantity After Crediting Offset Deficit
13. Cobalt	LB Co	85,400,000	40,802,305	510.0		44,597,695
14. Columbium Group	LB Cb Metal	4,850,000	2,510,528	30.9		2,339,472
Columbium Carbide Powder	LB Cb	100,000	21,372	.6		78,628
Columbium Concentrates	LB Cb	5,600,000	1,780,463	22.9		d
Columbium, Ferro	LB Cb	0	930,911	5.9	d	
Columbium, Metal	LB Cb	0	44,851	1.5	d	
15. Copper	ST	1,000,000	29,048	44.7		970,952
16. Cordage Fibers, Abaca	LB	155,000,000	0	-		155,000,000
17. Cordage Fibers, Sisal	LB	60,000,000	0	-		60,000,000
18. Diamond, Industrial Group	KT	29,700,000	40,952,009	469.6	11,252,009	
Diamond Dies, Small	PC	60,000	25,473	1.1		34,527
Diamond, Industrial, Crushing Bort	KT	22,000,000	23,692,817	47.4	1,692,817	
Diamond, Industrial, Stones	KT	7,700,000	17,246,456	421.1	9,546,456	
19. Feathers and Down	LB	1,500,000	0	-		1,500,000
20. Fluorspar, Acid Grade	SDT	1,400,000	895,983	161.3		504,017
21. Fluorspar, Metallurgical Grade	SDT	1,700,000	411,738	51.5		1,288,262
22. Graphite, Natural, Ceylon, Amorphous Lump	ST	6,300	5,499	10.7		802
23. Graphite, Natural, Malagasy, Crystalline	ST	20,000	17,903	35.8		2,097
24. Graphite, Natural, Other Than Ceylon & Malagasy	ST	2,800	2,804	2.0	4	
25. Iodine	LB	5,800,000	7,756,004	53.4	1,956,004	
26. Jewel Bearings	PC	120,000,000	70,423,653	75.4		49,576,347
27. Lead	ST	1,100,000	601,036	342.6		498,964
28. Manganese, Dioxide, Battery Grade Group	SDT	87,000	222,136	21.3	135,136	
Manganese, Battery Grade, Natural Ore	SDT	62,000	219,125	16.7	e	
Manganese, Battery Grade, Synthetic Dioxide	SDT	25,000	3,011	4.6		e

Commodity	Unit	1980 Goal	Inventory	Value of Inventory (Millions $)	Quantity After Crediting Offset	
					Excess	Deficit
29. **Manganese, Chemical & Metallurgical Group**	ST Mn Metal	1,500,000	1,970,722	466.7	470,722	
Manganese Ore, Chemical Grade	SDT	170,000	221,044	18.1	5,044	
Manganese Ore, Metallurgical Grade	SDT	2,700,000	3,370,104	186.1		f
Manganese, Ferro, High Carbon	ST	439,000	599,978	262.5	f	
Manganese, Ferro, Low Carbon	ST	0	0	-	-	
Manganese, Ferro, Medium Carbon	ST	0	28,920	22.0	f	
Manganese, Ferro, Silicon	ST	0	23,574	11.6	f	
Manganese Metal, Electrolytic	ST	0	14,172	21.3	f	
30. **Mercury**	FL	10,500	189,016	74.2	178,516	
31. **Mica Muscovite Block, Stained & Better**	LB	6,200,000	5,212,445	27.8		987,555
32. **Mica Muscovite Film, 1st & 2nd Qualities**	LB	90,000	1,274,489	14.9	1,184,489	
33. **Mica Muscovite Splittings**	LB	12,630,000	18,706,854	28.1	6,076,854	
34. **Mica Phlogopite Block**	LB	210,000	130,745	.2		79,255
35. **Mica Phlogopite Splittings**	LB	930,000	1,680,947	3.4	750,947	
36. **Molybdenum Group**	LB Mo	0	0	-	-	
Molybdenum Disulphide	LB Mo	0	0	-	-	
Molybdenum, Ferro	LB Mo	0	0	-	-	
37. **Nickel**	ST Ni+Co	200,000	32,210	211.9		167,790
38. **Opium Group**	AMA LB	130,000	71,303	29.6		58,697
Opium, Gum	AMA LB	0	31,795	6.7	g	
Opium, Salt	AMA LB	130,000	39,508	22.9		g
39. **Platinum Group Metals, Iridium**	Tr Oz	98,000	16,990	10.2		81,010
40. **Platinum Group Metals, Palladium**	Tr Oz	3,000,000	1,255,003	156.9		1,744,997
41. **Platinum Group Metals, Platinum**	Tr Oz	1,310,000	452,642	215.0		857,358
42. **Pyrethrum**	LB	500,000	0	-		500,000
43. **Quartz Crystals**	LB	600,000	2,066,140	12.4	1,466,140	
44. **Quinidine**	Av Oz	10,100,000	1,800,436	5.5		8,299,564
45. **Quinine**	Av Oz	4,500,000	3,246,164	7.2		1,253,836

Commodity	Unit	1980 Goal	Inventory	Value of Inventory (Millions $)	Quantity After Crediting Offset Excess	Quantity After Crediting Offset Deficit
46. Rubber	MT	864,000	120,557	125.5		743,443
47. Rutile	SDT	106,000	39,186	12.7		66,814
48. Sapphire and Ruby	KT	0	16,305,502	.2	16,305,502	
49 Silicon Carbide, Crude	ST	29,000	80,550	36.2	51,550	
50. Silver, Fine	Tr Oz	0	137,505,946	1,001.7	137,505,946	
51. Talc, Steatite Block & Lump	ST	28	1,092	.4	1,064	
52. Tantalum Group	LB Ta Metal	7,160,000	2,391,940	165.7		4,768,060
Tantalum, Carbide Powder	LB Ta	0	28,688	4.7	h	
Tantalum Metal	LB Ta	0	201,133	44.2	h	
Tantalum Minerals	LB Ta	8,400,000	2,551,302	116.8		h
53. Thorium Nitrate	LB	600,000	7,131,812	19.6	6,531,812	
54. Tin	MT	42,700	194,600	2,715.9	151,900	
55. Titanium Sponge	ST	195,000	32,331	458.8		162,669
56. Tungsten Group	LB W Metal	50,666,000	79,875,035	655.1	29,209,035	
Tungsten Carbide Powder	LB W	2,000,000	2,032,942	30.2	i	
Tungsten, Ferro	LB W	0	2,025,361	24.8	i	
Tungsten, Metal Powder	LB W	1,600,000	1,898,911	26.4	i	
Tungsten Ores & Concentrates	LB W	55,450,000	86,859,955	583.7	i	
57. Vanadium Group	ST V Metal	8,700	541	6.5		8,159
Vanadium, Ferro	ST V	1,000	0	-		1,000
Vanadium Pentoxide	ST V	7,700	541	6.5		7,159
58. Vegetable Tannin Extract, Chestnut	LT	5,000	15,920	10.4	10,920	
59. Vegetable Tannin Extract, Quebracho	LT	28,000	138,177	93.9	110,177	
60. Vegetable Tannin Extract, Wattle	LT	15,000	15,804	10.9	804	
61. Zinc	ST	1,425,000	378,320	293.2		1,046,680

Offsets

a. **Aluminum Oxide, Fused Crude:** Hold 50,904 ST of aluminum oxide abrasive grain and 249,867 ST of aluminum oxide fused crude as offset against 379,253 LCT of bauxite abrasive grade.

b. **Castor Bean Oil:** sebacic acid inventory is credited toward castor bean oil goal at the rate of 2.5 to 1.

c. **Chromium Group, Chemical and Metallurgical Grades:** metallurgical grade ore goal is 3,200,000 SDT of specification grade; inventory 1,956,824 SDT; shortfall 1,243,176 SDT.

(1) Hold 217,695 ST of Fe Cr high carbon against shortfall of 544,238 SDT of specification grade ore.
(2) Hold 243,892 ST of Fe Cr low carbon against 609,730 SDT of specification grade ore.
(3) Hold 89,208 SDT of non-specification grade metallurgical ore against the balance of the 89,208 SDT specification grade ore shortfall.
(4) Hold 47,466 SDT of non-specification grade metallurgical ore against a shortfall of 31,644 ST of Fe Cr Si.
(5) Hold 56,830 SDT of non-specification grade metallurgical ore against a shortfall of 16,237 ST of chromium metal.
(6) Hold 337,715 SDT of non-specification grade metallurgical ore against 337,715 SDT of chemical grade ore shortfall.

d. **Columbium Group:**

(1) Hold 930,911 pounds Cb as Fe Cb against 1,095,189 pounds Cb as concentrates.
(2) Hold 44,851 lb Cb as Cb metal against 52,766 lb Cb as concentrates.

e. **Manganese, Dioxide, Battery Grade Group:**

Hold 21,989 SDT of manganese, battery grade, natural ore against a shortfall of 21,989 SDT of manganese, battery grade, synthetic dioxide.

f. **Manganese Group, Chemical and Metallurgical Grades:** metallurgical grade ore goal is 2,700,000 SDT; inventory 2,409,377 SDT; shortfall 290,623 SDT of stockpile grade ore.

(1) Hold 14,172 ST of Mn metal against 35,430 SDT of metallurgical ore.
(2) Hold 23,574 ST of Fe Mn Si against 47,433 SDT of metallurgical ore.
(3) Hold 28,921 ST of Fe Mn medium carbon against 57,842 SDT of metallurgical ore.
(4) Hold 77,460 ST of Fe Mn high carbon against 154,920 SDT of metallurgical ore.
(5) Hold remaining 83,518 ST of Fe Mn high carbon against reduction of ore value in desired inventory mix.

g. **Opium:** Hold 31,795 AMA lb of opium gum against 31,795 AMA lb of opium salt goal.

h. **Tantalum Group:**

(1) Hold 201,133 lb Ta as Ta metal against 237,337 lb Ta as concentrates.
(2) Hold 28,688 lb Ta as Ta C against 33,852 lb Ta as concentrates.

i. **Tungsten Group:**

(1) WC powder goal is 2,000,000 lb W; stockpile grade inventory 1,921,167 lb W; shortfall 78,833 lb W. Hold 111,775 lb W as non-specification grade WC to offset 78,243 lb W as WC specification grade (assume 70% recovery of usable W).

(2) W metal powder goal is 1,600,000 lb W; inventory stockpile grade 1,566,964 lb W; shortfall 33,036 lb W. Non-stockpile grade W metal powder inventory is 331,947 lb W. Assume 70% recovery as usable material, then 331,947 x .70 = 232,363 lb W. Hold 47,194 lb W as non-specification grade powder to offset shortfall of 33,036 stockpile grade W powder.

(3) Hold balance of non-stockpile grade W powder 232,363 - 33,036 = 199,327 lb W as powder against 234,209 lbs W as concentrate.

(4) Hold 840,752 lbs W as Fe W stockpile grade against 987,884 lb W as concentrate. Hold 1,184,609 lb W nonstockpile grade Fe W at 70 percent recoverable against 974,341 lb W concentrate.

APPENDIX 2

CALCULATION PROCEDURE FOR FAMILY GROUPINGS OF MATERIALS

The following example is designed to help the reader perform and understand the conversions and calculations used in preparing summary lines for basic family groupings. The purpose in using basic units for each of the families or groups of materials is to place the content of the primary material into a common denominator for easier comparison.

In time of emergency, these would be a need for a mix of various forms of each metal element. The stockpile goal for a metal is a mix of products at various stages of upgrading. The goal is calculated by examining expected wartime requirements, availability, and domestic capacity to produce each of the upgraded forms.

There is a different factor for converting each of the forms into a common denominator, usually the basic metal equivalent. The conversion factors are different because process conversion losses vary. The calculations and conversions used for the aluminum oxide abrasive grain group are shown as an example.

The aluminum oxide abrasive grain group has a surplus of aluminum oxide abrasive grain and of aluminum oxide fused crude but has a deficit of bauxite abrasive grade. Both aluminum oxide abrasive grain and fused crude are used to offset the shortfall in the abrasive grade bauxite but in different proportions for each because of upgrading processing losses.

PROCEDURE

1. The available surplus of aluminum oxide abrasive grain is 50.904 ST. To calculate the abrasive grade bauxite equivalent, multiply by the conversion factor: 1/.641026 times 50.904 equals 79.410 LCT of bauxite equivalent.

2. The available surplus of aluminum oxide fused crude is 249.867 ST. To convert this into bauxite equivalent multiply by the conversion factor: 1/.83333 times 249.867 equals 299.840 LCT bauxite equivalent.

3. Add the two bauxite equivalents to find the total offset: 79.410 plus 299.840 equals 379.250 LCT.

4. The bauxite abrasive grade goal is 1,000,000 LCT; therefore subtract the offset of 379.250 LCT leaving a deficit of 620.750 LCT.

Senator **Hecht**. I'm from Nevada and it's very critical to our state, so I'd appreciate it very much.

Thank you, Mr. Chairman.

Senator **Trible**. I thank my colleague.

Gentlemen, in my first line of questioning I was trying to establish more specifically for the record the kinds of things you do. That was not obvious from your very learned statements today—your prepared statements.

Mr. **Donnelly**. I'd like a chance to tell you what we do in the Defense Department.

Senator **Trible**. Please. I didn't mean to overlook DOD.

Mr. **Donnelly**. Well, I was so interested in hearing what my colleagues said that I just thought I'd be quiet.

Senator **Trible**. This might be a useful exercise for all of us.

Mr. **Donnelly**. That's right. Often in Defense we forget. Sometimes we think we are the only agency on the block, so it's good to hear my associates talk to national security issues.

Just to build a little bit on what Mr. Brady and Mr. Richards were talking about, about the industrial priority ratings, we do indeed put an industrial priority rating on all of our important contracts with industry. That rating is either a DX rating or a DO rating. The DX ratings are very few in number. They are used on programs that are approved by the President as being of the highest national urgency. The DO rating goes on most of the other contracts.

We do require our prime contractors to pass that rating down the industrial chain for products and components that are needed to be incorporated in the end item that we're buying.

If I could give an illustrative example of how that has worked in the past, it basically operates on an exception basis. It's a tool that we have that we can bring out of the closet as a club if necessary. Where it doesn't work and we have to occasionally ask for special priority or assistance is one example I would like to give.

Back in the 1979-1980 time frame when we were experiencing very substantial bottlenecks and delays within industry, we got into a point where one of our jet engine producers fell behind schedule. There were different reasons for them falling behind, not the least of which was a strike at one of their subcontractor plants.

The bottom line of the whole thing was we suddenly found ourselves having aircraft produced with big holes in the side where the engines were supposed to go. That translates very rapidly into cost growth, stretchouts in production of the end item, and obviously a threat to our readiness.

The Commerce Department was asked by the Office of the Secretary of Defense to see what they could do to expedite the vendors and suppliers down below that engine producer and they literally came up with a scheme where we could obtain 60 more engines within that calendar year, and that was 60 more than the Defense Department with all our resources thought that we could do in the first place.

The other thing that was very interesting, even with the rapid increase in delivery was that there were virtually no complaints from the vendors and suppliers down the chain that we were unnecessarily disrupting their schedule. So in this case, I'm sure it saved hundreds of millions of dollars and made us more ready at the same time.

Just one other final comment, the Defense Production Act is the basis for a lot of the programs that we operate within the Defense Department including the industrial preparedness area that allows us to consult with industry for obtaining the best possible delivery times for mobilization. Indeed many of the programs we operate, like our manufacturing technology program, are carried out in relationship mode with the Defense Production Act programs.

Senator **Trible**. Thank you. I think that adds a lot to the record.

DISAGREEMENT OVER LENGTH OF REAUTHORIZATION

Let me ask you this question. We have unanimously agreed today that the DPA should be reauthorized for a substantial period of time. There is a disagreement developing between the House and Senate over the length of that reauthorization.

My concern is, as stated here before, an extension of short duration could very well result in a lapse of authority and termination of the program. I think that would have adverse consequences on our national defense posture and on the cost of government.

Have any of your agencies prepared an estimate of the cost that might result from an expiration of DPA authorities? Is there a way to assess that result more precisely?

Mr. **Brady**. We have not prepared a dollar cost, Mr. Chairman, at least not at Commerce. I think the cost, for instance, all the priorities and allocations that we are talking about would evaporate and they would no longer be a priority—I think it's conceivable that the costs escalate particularly with big delays which might become severe in some of the DPA activities.

Mr. **Krueger**. I think, in addition, that the Act provides certain legal authority and legal remedies to defense contractors who are forced to let commercial contracts slip. If the authorities were not there, I think you would find that the Department of Defense would have to pay almost like an insurance premium for each and every defense contract because the commercial vendor would want to protect himself.

There are times when it's deemed in the national interest for the Department of Defense to talk with defense contractors, and I think most commercial firms have a degree of patriotism and would honor the pleadings of the DOD, but they would also want protection. Right now they get the legal protection from the Defense Production Act. Without that, I think DOD would on each and every contract be paying some amount for that protection.

In addition, there would be the cost of delayed contracts, stretched-out contracts, etc. I don't know if there is a precise number on that, but I think that's Mr. Donnelly's purview.

Mr. **Donnelly**. Well, as I said in my testimony, Mr. Chairman, we have not examined from a cost standpoint the full implications of loss of the authority. The way to explain that is back to my statement earlier, that there is no separate defense industrial base. We happen to own 77 plants that are operated by contractors for us, but we do business at different times with over 20,000 different companies. As you can imagine, it would be very difficult to array the cost associated with all those contracts at the same time, although we have had some informal information that some of our high priority programs could be delayed as far as operational capability by a year if the Act would lapse.

We have had information, from an illustrative standpoint, that without the Defense Production Act authorities we could have a 1-year slippage in many of our more important programs. A 1-year slippage does translate into very massive amounts of dollars obviously.

Senator TRIBLE. What I'd like each of you to do if you would, from the perspective of your agency, is if you would submit for the record as precise a computation as is possible the costs of terminating this program or a lapse of this program. That may be an impossibility, but for those of us that would take the floor of the House and Senate and argue for reauthorization and for reauthorization for a substantial term, it will be essential that we can document our case and point to the dollars and cents involved here; and they are, no doubt, substantial, in view of your testimony.

Mr. KRUEGER. In addition to the agencies represented here and the departments represented here, the Department of Energy also relies on these authorities both for the manufacture of weapon systems as well as the expansion of domestic energy supplies, and the Departments of the Interior and Transportation make significant use of these authorities.

Senator TRIBLE. Mr. Kruger, since you represent the coordinating agency here, may I ask you to perhaps include those in your cost estimates?

Mr. KRUEGER. I would be happy to, sir.

COST ESTIMATES FOR EXPIRATION OF THE DEFENSE PRODUCTION ACT

These costs estimates are currently unavailable. We will be working with the appropriate agencies to develop suitable criteria to establish costs estimates for the expiration of the Defense Production Act and inform this Committee accordingly.

Mr. BRADY. Mr. Chairman, I'm told hundreds of thousands of priorities exist out there now. Havoc would reign if they were to be wiped out. We talked for a moment about contractors trying to deliver because of their sense of patriotism. I'm not sure that one lawsuit, however, from a supplier who's being discriminated against would not also wreak havoc with that sense of patriotism. I'm trying to underscore the absolute importance of not letting this act lapse.

Senator TRIBLE. If you could arm us with some additional information, that would be quite helpful.

FUNDING PROGRAMS

Now we've talked about the specific activities permitted by this act. We have set the groundwork for a meaningful reauthorization of the act. Let me focus, if I might, on title III, specifically the $200 million funding for programs under title III of the Defense Production Act.

It's my understanding, Mr. Donnelly, that the Department of Defense played an important role in persuading OMB to request this funding. For what purpose are these moneys requested?

Mr. **Donnelly**. I guess it is true that we played an important role in working with OMB on the matter, as well as other representatives that are here today. They also played an important role.

The purpose of the request is, as I stated in my testimony, that in those cases where the free market economy is not expected to do its thing and that some extraordinary action is required on the part of the Federal Government to bring a domestic production capability on-line, then these dollars would be used as purchase guarantees to provide that needed capability.

Senator **Trible**. Well, I understand the authority and it's an ongoing one, but I'm troubled when the Congress is asked to appropriate a quarter of a billion dollars for an unspecified purpose. Can you be more specific about our national requirements and to what end those monies will be put?

Mr. **Donnelly**. Well, just as a minor housekeeping item, $50 million is taken out of the Defense budget in 1983 as not an additional appropriation. The $200 million in 1984 is a separate amount.

As far as the types of programs, I can say that there is no shortage of potential programs that some people believe we ought to be spending that money on. What we're doing at the present time is to make sure that we have a scheme of priorities that the Defense Department can bring to bear that will allow us to say which projects should be more important than others, again with the idea of whether the economy can do it on its own or not. I can tell you that cobalt has not been recommended by the Department of Defense at this point for title III. Neither has any other project been recommended at this point. But all of them fall in the same philosophy, I believe, where domestic production capability either does not exist or that does not exist in the amount required to support emergency needs and forces.

Senator **Trible**. What moneys are available to you in prior appropriations?

Mr. **Donnelly**. None that I know of, sir.

Senator **Trible**. You mean all the dollars heretofor authorized and appropriated have been expended?

Mr. **Krueger**. For title III, yes; $1.2 billion of borrowing authority was provided in the basic act in the early 1950's.

Senator **Trible**. $1.2 billion?

Mr. **Krueger**. $2.1 billion. In today's dollars, that may be as many as $10 billion. Using this money, the executive branch——

Senator **Trible**. Let me interrupt you there. I didn't quite understand. You said in today's dollars that might be——

Mr. **Krueger**. As much as $10 billion.

Senator **Trible**. Is this indexed to inflation?

Mr. **Krueger**. Yes. Well, 1950 was 30 years ago, and it's somewhere between a factor of 3 and 5 in terms of dollars. I don't know what the exact amount is but $2 billion in 1950 dollars is somewhere between $8 and $10 billion today.

Senator **Trible**. But a $2-billion authorization in 1950 is a $2 billion authorization today. It just doesn't buy as much, Mr. Krueger.

Mr. **Krueger**. That is true. I wasn't trying to argue that. I was just trying to say that——

Senator **Trible**. I was alarmed by the suggestion that the authorization accelerates as the years pass. You still have the same total authorization, do you not?

Mr. **Krueger**. At this point, the borrowing authority lapsed in 1974. Using this authority in the early 1950's, some $9 billion worth of contracts were signed, and some $500 million were actually expended. In addition to that, there was $3 billion of loans and $3 billion of loan guarantees. $500 million were actually expended, and the interest on those expenditures accrued over time. By 1974, $1.6 billion worth of back interest payments had accrued. The borrowing authority in effect was bankrupt and Congress dissolved the debt. But there was over $9 billion worth of projects funded using this leverage mechanism of price guarantees or assured purchase.

Senator **Trible**. Mr. Brady.

Mr. **Brady**. Mr. Chairman, let me try to answer the question in more of a macro way.

In December of 1981 the President established an Emergency Mobilization Preparedness Board, now chaired by Judge Clark. I chair the industrial mobilization working group for that board. One of the major problems that we're trying to come to grips with is to describe what kind of an industrial base we have, particularly after you move away from the primary industries. But as you move into the second and third level of supporting industries, real questions develop as to exactly what capabilities we have in this country, and the ability, both short, medium and long-term, to be able to sustain the kind of defense posture that we believe we must have.

PROBLEMS IN MAJOR INDUSTRIES

Now we know that we have problems for 25 to 40 of what I'd call major industries. After we get the work accomplished that we have set out in the work program, we will have a much better idea, for instance, of precisely which industries are fundamentally critical to the defense posture.

Second, how are they going to survive for the rest of this decade and the rest of the century in terms of the open world competitive system? That brings us then to the question of what do we need to do to preserve that industrial base? Do we need to preserve it, or are our foreign sources of supply adequate, etc.? And that's where title III comes into play.

We have got some examples of problems already. The forging industry is a problem. Cobalt was mentioned. There's been a lot of work done on synthetic rubber. The titanium industry is a problem. Upgrading the stockpile from chromium ore to ferrochrome. These are the kinds of issues that don't even begin to address what I call the capital equipment and machinery moderization investment program that may be required for some critical industries necessary to support the industrial base. That's really what we're talking about under title III.

Senator **Trible**. Well, I understand the purpose and the national requirement. I think you've helped establish that for the record.

Mr. **Donnelly**. Mr. Chairman, there are $30 million in fiscal year 1981 and fiscal year 1982 DOD authorization acts, however no appropriations. That $30 million I believe has been in there for the past several years.

Senator TRIBLE. That's an authorization or an appropriation?

Under section 711, as I understand it, there's an open-ended authorization, so moneys then are made available through the appropriations process from time to time. So you have $30 million in hand then?

Mr. DONNELLY. Not appropriated. Authorized but not appropriated.

Senator TRIBLE. Who is this gentleman?

Mr. DONNELLY. Mr. John Eck of my staff.

Mr. ECK. We were authorized $30 million in the Defense Appropriations Act, $30 million worth of authority for loan guarantees. It was not an appropriation. It was in the Appropriations Act that allows us to enter into a loan guarantee. This year, in 1983, we had $50 million authorized to purchase commitments and that allowed us to reprogram $50 million. It did not provide us $50 million additional.

Mr. PEACH. Mr. Chairman, I just wanted to add another consideration that I think you should keep in mind.

In general, I think a lot of the authority was used during the Korean war situation and the period in that time where they were using some of this authority to provide this basic industry kind of support, and I think one of the questions that could be examined also in that area in looking at where we need to go now is once the wartime kind of environment and situation was over, what happened to the various industries and the capacity that was provided through providing that support because, again, you get into measure of what's appropriate to do when we're still in a peacetime situation to provide support to build up an industry and whether the industry will be able to sustain itself once that kind of buildup period is over.

So I think those are kinds of considerations that do need to be brought to bear.

Senator TRIBLE. It's been brought to my attention, Mr. Peach, that GAO is looking into the effectiveness of DPA programs in the 1950's. My understanding is that most of the production programs were termined once the subsidy program expired.

Mr. PEACH. We're in very preliminary stages. This is an area that we had on the agenda to look at. We're not very far into that area, but one of the reasons for looking into it was a concern that a great deal of the capacity that was brought online at that point in time did drop out of the picture shortly after the emergency kind of situation was over because it was not able to compete effectively.

Senator TRIBLE. Do you have a timetable for completing that study, Mr. Peach?

Mr. PEACH. No, we don't at this point in time. It's something that we have on the agenda in terms of wanting to get started because of the general information we've seen in that area.

PURPOSE OF $200 BILLION APPROPRIATION

Senator TRIBLE. All right. Let me get back to my original question that began this round of discussion, and that related to the

$200 million appropriation requested for title III in this year's budget submission. My question was the purpose for that funding and how those moneys would be used and, Mr. Donnelly, you were less than specific.

Do I gather from your testimony that you are unable to answer that question today?

Mr. DONNELLY. I think I'm unable to answer it if you're asking for specific programs, Mr. Chairman. The answer is I do not have that with me. I think I have enough on our menu of proposed programs where I could obviously provide that, but it wouldn't make much sense. The reason I'm being so ambivalent with you is that just the mere fact that the Government is considering an incentives program for various product lines tends to make our office very popular with those sectors who would like to have a piece of that action. We're trying our best to stay within those circumstances that are extraordinary and not give any type of signal of a bailout program.

Senator TRIBLE. What procedures do you follow in making this kind of decision? For example, do you prepare a detailed cost-benefit analysis for the projects that would be funded?

Mr. DONNELLY. I think that that has to be part of it. If you look at some of the other things the Defense Department has to do, of course, we want to be efficient and effective and we want to make the best use of the taxpayers' dollars. But some of these programs do cost money and sometimes you have to pay for the preparedness that the program would give. There is a delta above the usual cost effectiveness.

Senator TRIBLE. I don't think anybody disputes that and this Senator I think has established through his 7 years in Congress that he's a staunch supporter of a strong national defense and I believe that this program is an important one. However, I must say that this Senator also is troubled by the provision of law that permits agencies of Government to spend potentially billions of dollars without any oversight on the part of the elected representatives of the people who pay for those programs.

Mr. DONNELLY. Certainly we wouldn't want to give anybody the impression that we were spending money not appropriated. All of the programs that we will be intending to fund are subject to the appropriations process. That is, we have people looking over our shoulders in the Appropriations Committee and there may be something for your committee staff to consider further as far as your involvement there. I'm not sure it would be in the interest of everyone to examine every project even if it's $10,000 or $500,000. There's probably a threshold that those who want to oversee the program would want to have established. In other words, if an individual project went over, say, $50 million, that would be a candidate for a more detailed review by the oversight people. That's similar to the way OMB really operates with the Defense Department in this case. When we reach a threshold, then there will be more of a micro look at the projects.

As an analogy, one of the other programs that I run is the DOD manufacturing and technology program. That program has spent $745 million over the past 5 years. That was a doubling over the previous past 5 years and the idea of the program is to take manufacturing techniques that are proven in the laboratory and then put them out on the factory floor to reduce leadtimes and improve productivity and so forth. Backup material for the projects being considered under manufacturing and technology is available through the normal appropriations process.

In fact, I'm convinced there is more than ample oversight for us on this particular matter.

Senator **TRIBLE**. Perhaps there is within the executive branch, but what you're doing is asking for the Congress to blindly appropriate $200 million this year.

Mr. **KRUEGER**. Senator, I know you used to sit on the Seapower and Strategic and Critical Materials Subcommittee of the House Armed Services Committee and I might review for the people here how that process works.

There is a blanket appropriation for the purchase of stockpile materials. However, we do submit to the Congress and the Armed Services Committee a shopping list, if you will. Originally, that was done informally. Now it is part of the statute that we must submit this shopping list, and it was shared with the staff. Particularly in the area of raw materials, the markets can be very volatile. You can't predict with much precision which way prices will move or predict certain situations. What we heard before about cobalt is a good example. The budget process is about 2 years long. As you start to put together these projects, you can't forecast what the prices will be. This informal review process with the committees and even the more formal review process with the committees and with the committee staffs and a good working relationship there can provide, I think, the type of oversight you're suggesting. I know it's worked well in the stockpile area.

Senator **TRIBLE**. Thank you, Mr. Krueger. I think that arrangement has worked well and I'm going to encourage my colleagues to search for a way that will not unduly delay or interfere with the important work of title III but that will give Congress some oversight authority so that we can insure that these limited-taxpayer dollars are well spent, and I think there is a mechanism that will permit us to carry out our responsibilities here and also permit you to carry on the important job that you have been given.

To that end, I would ask each of you to give some thought to how that might be structured because I'm going to ask my staff here to seek your advice and counsel in that regard.

Also on the question of cobalt pricing, I don't think there's any reason to pursue that today. Obviously we were in a very fluid situation and facts and circumstances change, but the committee will want to pursue that question and we would ask Mr. Krueger if you and your people and Mr. Peach you and your associates to work with us so that we can as precisely as possible assess the cost of any proposal.

Mr. **KRUEGER**. Do you want a formal response to the GAO testimony from the administration?

Senator **TRIBLE**. I think that would be very helpful.

Information subsequently supplied for the record can be found on p. 127.]

Gentlemen, is there anything else you would like to add to what's been said today?

[No response.]

Senator **Trible**. I thank you very much. I think this has been a good session and I know we will benefit from the testimony.

[Whereupon, at 11:40 a.m., the hearing was adjourned.]

Federal Emergency Management Agency
Washington, D.C. 20472

March 1, 1983

Honorable George Bush
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

The Defense Production Act of 1950 is the cornerstone of the present legal structure for ensuring that we are prepared to meet national emergencies requiring the mobilization of the Nation's industrial and material resources. Its continuation is essential to the national defense. Enclosure A is proposed legislation which would extend the Defense Production Act for an additional 5 years.

Title I of the Defense Production Act provides authority to require priority treatment for vital defense contracts as well as authority to allocate materials and facilities for defense programs. It is under these authorities that the Departments of Commerce, Energy, and Transportation have established specific resource priority and allocation systems. Failure to extend the Act will lead to severe and costly impacts on our weapons acquisitions and defense preparedness programs. See Enclosure B.

A 5-year extension will provide orderly programming for expansion of essential industrial capacity and resource supply projects which require several years for completion. In addition, the Administration has authority in Fiscal Year 1983 and is seeking funding in Fiscal Year 1984 to carry out the purposes of Title III of the Act. This funding will help to expand productive capacity and supply beyond levels needed to meet civilian demand in order to reduce the time required for full mobilization.

The Office of Management and Budget advises that there is no objection to the submission of this proposal for the consideration of the Congress and that its adoption would be in accord with the program of the President.

Sincerely,

George Jett
General Counsel

Enclosures

Enclosure A

A BILL

To extend 5 years the expiration date of the Defense Production Act of 1950.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the first sentence of section 717(a) of the Defense Production Act of 1950 (50 U.S.C. App. 2166(a)) is amended by striking out "March 31, 1983" and inserting in lieu thereof "March 31, 1988."

Enclosure B

IMPACTS OF THE EXPIRATION
OF THE DEFENSE PRODUCTION ACT

Highest National Urgency Priority Rated Weapons Programs

Approximately 25% of defense procurements receive the highest national urgency DX priority ratings. These programs could experience delay and setbacks in production schedules due to the slower delivery of essential materials and equipment. DX programs can include such high priority projects as the B-1 bomber, Trident submarine, the MX missile program, command-control and communications systems, and the Abrams tank. The negative impact of the loss of priorities support for these weapon systems can severely affect our strategic posture.

Defense Priority Rated Programs

All other defense procurements receive DO priority ratings to help ensure the timely delivery of the goods and equipment and early completion of production schedules. Priorities support is extended for all military and atomic energy production and construction, foreign military assistance, and space projects. Expiration of the Act could stretch out delivery dates on all these programs. For example, the resulting slowdown in the delivery on foreign military assistance could negatively impact on our relations with friends and allies.

Deployment of Military Forces

The deployment of military forces in a major emergency would be severely hindered because the necessary transportation assets are made available for defense use under DP Act, Title I authorities. The Civil Reserve Air Fleet (CRAF), the Contingency Response Plan (CORE), and other rapid deployment plans and programs would be unable to operate without these authorities, and consequently the mobility of military forces is severely hampered.

Increased Procurement Costs

The lapse in DP Act extension or its termination would add to the costs of defense procurements because of the additional risk to the contractors in obtaining critical and scarce materials and equipment. Contracts let without priorities support could have difficulty in obtaining materials and equipment in future years especially if the economy heats up again as was the case in the late 1970's.

Transportation Strikes

Title I of the DP Act is the only Presidential authority (Section 101(b)) available to prioritize transport movements in the civil economy in the event of a rail or truckers' strike. This authority was used three times in the early 1970's and its use was planned in the recent air traffic controller and railroad strikes to ensure the movement of defense goods and personnel. Its absence will severely limit the President's ability to alleviate the impacts of a national transportation strike.

Machine Tool Trigger Order Program (MTTOP)

The basic authority for the establishment and maintenance of the Machine Tool Trigger Order Program (MTTOP) is Title III of the DP Act. Without this authority the program would have to be terminated and existing standby purchase agreements would have to be cancelled. To date, thirty-five companies have been invited to participate and approximately one-third of these standby agreements have been signed (16 agreements) covering 940 items with contract values of $222 million. The program is a government/industry cooperative effort to cut mobilization lead-times by speeding delivery of machine tools essential to defense production. Cancellation of the program would set back our mobilization preparedness effort with this industry by 12 to 18 months, if a mobilization occurred.

Loss of Mobilization Preparedness Lead Time

Dismantling the DP Act priorities and allocations systems and other contingency programs would seriously hinder any mobilization effort during the first 12 - 18 months because of the lack of trained personnel and administrative systems between government and industry.

Critical Materials and Forging Presses

New contracts for the guayule project would be prevented and DOD's overall project would be in danger.

National Defense Executive Reserve

The 11 NDER units would have to be disbanded and the reserve membership terminated by the departments and agencies with the resulting loss of talent and experience necessary for adequate mobilization preparedness.

Federal Emergency Management Agency
Washington, D.C. 20472

APR 21 1983

Honorable Paul S. Trible
Committee on Banking, Housing
and Urban Affairs
United States Senate
Washington, D.C. 20510

Dear Senator Trible:

During the oversight hearing on the Defense Production Act held on March 21, 1983, which you chaired, there were a number of questions regarding the cobalt analysis published by the Federal Emergency Management Agency (FEMA). The Director of the Resources, Community and Economic Development Division of the General Accounting Office (GAO) presented an evaluation of the FEMA cobalt analysis at the hearing. We are concerned because there are several inaccuracies in the GAO review. Therefore, we are sending this letter to Members of the Senate Banking, Housing and Urban Affairs Committee to clarify our views on these issues.

First, we believe that price forecast sources are incorrectly cited and that the forecast price comparisons presented are inconsistent in the GAO review. Economic forecasts of consumption and market price for each policy option considered in the cobalt analysis were made by the Office of Commodity Policy (OCP), Department of Commerce, as indicated on page 38 of the FEMA analysis. The economic and budgetary impacts were calculated and analyzed by FEMA, using the OCP forecasts. GAO compared the price forecasts of the OCP cobalt market model used in the FEMA cobalt analysis with the Department of the Interior cobalt market model price forecasts. Forecasts from these two models are made under significantly different market scenarios.

The price forecast made for the Department of the Interior, reported by GAO, is a "no policy" or "do nothing" forecast, while the price selected in the FEMA analysis for comparison is the "Stockpile Only" price forecast. The policy options were structured to permit a comparison of costs under circumstances that provided equal amounts of national security protection. Thus, for example, one can compare the economic and budgetary costs of buying some cobalt and stimulating some domestic production against the alternative of just buying cobalt for the stockpile. In fact, three explicitly defined stockpile/domestic production combinations were examined against the alternative of stockpiling alone. Comparisons were made under the assumption of a continuation of normal supplies and a major cobalt supply disruption. The "Stockpile Only" policy option (as described on pages 7 and 41 of the FEMA analysis) is not a "do nothing" cobalt supply protection policy. Under the "Stockpile Only" option, 45 million pounds of cobalt are purchased for the stockpile over the 10-year period 1981-1990. As indicated in the FEMA analysis (page 41), the larger acquisition program required in the "Stockpile Only" option places an upward pressure on price, with a cobalt price forecast, on average, 16 percent higher than in the "No Policy" base case in the FEMA analysis, and as much as 31 percent higher in a single year.

We share GAO's concern for long-term strategic and critical material availability, particularly in cases such as cobalt. The cobalt stockpile goal inventory shortfall represents a long-term shortage risk. Further, in peacetime the cobalt market can be described as volatile--United States and world supply highly vulnerable to interruption, and defense and essential industrial production sensitive to the unavailability of cobalt.

Cobalt reserves are limited as GAO asserts. Reserves of all minerals are limited. By definition, reserves are limited by the amount of developmental work that has occurred up to a given point in time. However, United States cobalt reserves and anticipated annual production rates (presented on page 33 of the FEMA analysis) are substantial. The production life of these near-term domestic prospects ranges from 20 to 30 years. Beyond the 30-year time frame, other domestic resources could be developed. According to testimony by the U.S. Geological Survey, "Domestic cobalt resources are quite large. . . only deposits located in Idaho, Missouri, Oregon, California, and Montana are capable of providing cobalt in the near future," but "excellent potential exists for finding yet undiscovered domestic deposits similar to important deposits in Zaire and the U.S.S.R."

The recent cobalt stockpile acquisition of 5.2 million pounds has not been overlooked, as indicated by GAO. The acquisition was underway during the culmination of the analysis (as documented on page 30 of the analysis). The impact on unfilled stockpiling requirements, however, was rendered moot at that time by the actual cobalt stockpiling requirement calculations. The actual calculated stockpiling requirements for cobalt are 92.4 million pounds, 7 million pounds higher than the 85.4 million pound published stockpile goal. This information, it may be noted, has been made available to GAO in earlier investigations.

GAO criticizes the validity of a long-term price forecast from a short-term viewpoint. United States cobalt shortage vulnerability, and the respective supply protection policies considered in the FEMA analysis are long-term. Each of the policy alternatives considered requires multi-year implementation. The time frame of the analysis and the price forecasts used to evaluate policy alternatives are by necessity also long-term. Cobalt demand and price are closely related to industrial production. Thus, long-term market price forecasts are tied to the cyclical nature of the economy and to business cycles of primary cobalt consuming sectors of the economy. Economic recovery in the primary cobalt consuming sectors, generally, has been slower than the forecasts used in the OCP model as indicated below:

Index	Forecast Compounded Growth Rate 1980-1990 Percentages	Actual Compounded Growth Rate 1980-1982
Aircraft Engines & Parts	3.12	-8.07
Machine Tools (Non-Electrical Machinery)	6.08	-15.80
Chemical & Allied Products	5.40	-3.08
Radio & TV & Communication Equipment	3.69	11.00
Electronic Machinery	5.71	3.00

Thus, implicit in GAO's assumption, that is, purchasing the remaining cobalt needed in the "Stockpile Only" option at today's historically low cobalt price, is the stagnation of these economic sectors at already depressed production levels.

A copy of the August 1983 analysis entitled "Alternative U.S. Policies for Reducing the Effects of a Cobalt Supply Disruption -- Net Economic Benefits and Budgetary Costs" is enclosed. We will be pleased to meet with members or staff of the committee to review the issues further.

Sincerely,

BA Maguire
Bernard A. Maguire
Associate Director
National Preparedness Programs

Enclosure